National Library
of Canada

Acquisitions and
Bibliographic Services Branch

395 Wellington Street
Ottawa, Ontario
K1A 0N4

Bibliothèque nationale
du Canada

Direction des acquisitions et
des services bibliographiques

395, rue Wellington
Ottawa (Ontario)
K1A 0N4

Your file Votre référence

Our file Notre référence

NOTICE

The quality of this microform is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us an inferior photocopy.

Reproduction in full or in part of this microform is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30, and subsequent amendments.

AVIS

La qualité de cette microforme dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

La reproduction, même partielle, de cette microforme est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30, et ses amendements subséquents.

Canada

UNIVERSITY OF ALBERTA

CHILDREN'S READING COMPREHENSION MONITORING: EXPLORING THE RELATIONS AMONG ATTRIBUTION, GOAL/MOTIVE, KNOWLEDGE, PROCESS, STRATEGY, AND READING PERFORMANCE

BY

PUI-WAN CHENG ©

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

IN

SPECIAL EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

FALL, 1993

National Library of Canada

Acquisitions and Bibliographic Services Branch

395 Wellington Street
Ottawa, Ontario
K1A 0N4

Bibliothèque nationale du Canada

Direction des acquisitions et des services bibliographiques

395, rue Wellington
Ottawa (Ontario)
K1A 0N4

Your file Votre référence

Our file Notre référence

The author has granted an irrevocable non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of his/her thesis by any means and in any form or format, making this thesis available to interested persons.

L'auteur a accordé une licence irrévocable et non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de sa thèse de quelque manière et sous quelque forme que ce soit pour mettre des exemplaires de cette thèse à la disposition des personnes intéressées.

The author retains ownership of the copyright in his/her thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without his/her permission.

L'auteur conserve la propriété du droit d'auteur qui protège sa thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

ISBN 0-315-88094-5

Canada

UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR: Pui-wan Cheng

TITLE OF THESIS: Children's Reading Comprehension Monitoring: Exploring the Relations among Attribution, Goal/Motive, Knowledge, Process, Strategy, and Reading Performance

DEGREE: Doctor of Philosophy in Special Education

YEAR THIS DEGREE GRANTED: 1993

Permission is hereby granted to the University of Alberta Library to reproduce single copies of this thesis and to lend or sell such copies for private, scholarly or scientific research purposes only.

The auther reserves all other publication and other rights in association with the copyright in the thesis, and except as hereinbefore provided neither the thesis nor any substantial portion thereof may be printed or otherwise reproduced in any material form whatever without the author's prior written permission.

(Signed) ________________

Permanent Address:
4320 - 114 St.
Edmonton, Alberta
Canada T6J 1N1

Date: June 30, 1993

UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled **Children's Reading Comprehension Monitoring: Exploring the Relations among Attribution, Goal/Motive, Knowledge, Process, Strategy, and Reading Performance** submitted by Pui-wan Cheng in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Special Education.

R Mulcahy
Dr. R. Mulcahy

Maguire
Dr. T. Maguire

Grace Malicky
Dr. G. Malicky

RH Short
Dr. R. Short

L Wilgosh
Dr. L. Wilgosh

Dr. C. K. Leong

Date: June 30, 1993

Abstract

The intent of this investigation was to examine the nature of comprehension monitoring and its relationship to reading achievement by implementing several conceptual and methodological changes that were different from previous studies. First, a model of comprehension monitoring was developed; comprehension monitoring was conceptualized as a multidimensional construct comprised of five components: attribution, goal/motive, knowledge, process and strategy. All these components were investigated within a single research setting. Second, multiple dependent measures were used to obtain convergent evidence of comprehension monitoring. Furthermore, comprehension monitoring measures were employed along with comprehension measures.

The research involved 29 skilled and 30 less skilled sixth grade readers who each participated in three separate but related studies. Study 1 examined the goal/motive and knowledge aspect of comprehension monitoring; a structured metacognitive interview and a questionnaire in a parallel form were administered. Study 2, in which participants answered the Learning Process Questionnaire, investigated the relationship between learning motives in general and motives of reading/comprehension monitoring in particular. Study 3 examined the process, strategy, and attribution aspects of comprehension monitoring; an error detection task was employed to obtain multiple monitoring indicators with comprehension performance also measured. Finally, a series of path analyses were conducted to integrate the results of the three studies and delineate the relative importance of the comprehension monitoring components to reading comprehension performance.

The results indicated that the monitoring process had the strongest direct effect on comprehension performance. When indirect effects were also considered, goal/motive became the most influential component affecting comprehension performance. Goal/motive was also the most powerful factor influencing other monitoring components. Interpretation of these results, however, should be cautious in view of the relatively high correlation between goal/motive and knowledge.

The findings of this investigation thus offered some support for a multidimensional view of comprehension monitoring; goal/motive/knowledge and process, in comparison to strategy and attribution, had relatively greater effects on comprehension performance. These findings were discussed in terms of possible directions for further modification and refinement of the conceptualization and measurement of comprehension monitoring. Implications for educational applications were also presented.

BRIEF CONTENTS

Chapter Page

PART ONE: THEORETICAL AND EMPIRICAL ISSUES 1

1. INTRODUCTION 2
2. THEORETICAL FRAMEWORK 6
3. EMPIRICAL RESEARCH 33
4. METHODOLOGICAL CONSIDERATIONS 66

PART TWO: THE RESEARCH 73

5. RATIONALE, DEFINITIONS, AND RESEARCH QUESTIONS 74
6. DESIGN OF THE RESEARCH 81
7. STUDY 1: METACOGNITIVE INTERVIEW AND QUESTIONNAIRE 86
8. STUDY 2: LEARNING PROCESS QUESTIONNAIRE 114
9. STUDY 3: ERROR-DETECTION TASK 128
10. EXPLORING THE RELATIONS AMONG COMPREHENSION MONITORING COMPONENTS AND READING PERFORMANC 170

PART THREE: INTEGRATION 189

11. COMPREHENSION MONITORING: ANSWERED AND UNANSWERED QUESTIONS 190

REFERENCES 200

APPENDICES 215

TABLE OF CONTENTS

Chapter page

PART ONE: THEORETICAL AND EMPIRICAL ISSUES 1

1. INTRODUCTION 2
2. THEORETICAL FRAMEWORK 6
  2.1 Current theories of reading comprehension 6
    2.1.1 Reading as information processing 6
    2.1.2 Reading as schema building 9
    2.1.3 From reading theories to metacognitive literature 11
  2.2 Cognition and metacognition 12
  2.3 Conceptual issues of metacognition 14
    2.3.1 Historical roots 14
    2.3.2 Construct validity 16
  2.4 Cognitive monitoring: A fundamental form of metacognition 19
    2.4.1 Knowledge 19
    2.4.2 Process 21
    2.4.3 Strategy 22
    2.4.4 Goal/motive and motivational factor 23
    2.4.5 Relations among the components 24
  2.5 Comprehension monitoring: Cognitive monitoring in reading 25
    2.5.1 Knowledge 26
    2.5.2 Process 27
    2.5.3 Strategy 28
    2.5.4 Goal/motive and motivational factor 28
    2.5.5 Relation to reading proficiency 30
  2.6 Chapter Summary 31
3. EMPIRICAL RESEARCH 33
  3.1 Research on the knowledge aspect of comprehension monitoring 33
  3.2 Research on process and strategy aspects of comprehension monitoring ..37
    3.2.1 Data from error detection studies 37
    3.2.2 Data from behavioral indicators 49
    3.2.3 Data from performance prediction studies 50
    3.2.4 Data from verbal report measures 52
    3.2.5 Data from cloze test studies 55
    3.2.6 Data from other research techniques 57
  3.3 Research on goal/motive and related motivational factors in comprehension monitoring 60
  3.4 Chapter Summary 64
4 METHODOLOGICAL CONSIDERATIONS 66
  4.1 Metacognitive interview 66
  4.2 Error detection paradigm 69
  4.3 Chapter Summary 72

PART TWO: THE RESEARCH 73

5. RATIONALE, RESEARCH QUESTIONS, AND DEFINITIONS 74
5.1 Rationale 74
5.2 Definition of Terms 76
5.3 Research Questions 78

6. DESIGN OF THE RESEARCH 81
6.1 Overview of the research 81
6.2 Subjects 82
6.3 Pilot study 84
6.4 Chapter Summary 85

7. STUDY 1: Metacognitive Interview and Questionnaire 86
7.1 Method 86
7.1.1 Subjects 86
7.1.2 Materials 86
7.1.3 Procedure 89
7.1.4 Scoring 91
7.2 Results and discussion 92
7.2.1 Preliminary analyses 93
7.2.2 Overall performance 94
7.2.3 Goal/motive component 95
7.2.4 Knowledge component 99
7.2.5 Person category 99
7.2.6 Task category 101
7.2.7 Strategy category 105
7.2.8 Interview and questionnaire comparisons 107
7.3 General discussion 108
7.3.1 Relation between reading ability and metacognitive awareness. 108
7.3.2 Measuring metacognitive knowledge and motives of reading .. 110
7.3.3 Issues for future research 111

8. STUDY 2: LEARNING PROCESS QUESTIONNAIRE 114
8.1 Method 114
8.1.1 Subjects 114
8.1.2 Materials 114
8.1.3 Procedure 116
8.1.4 Scoring 117
8.2 Results and discussion 117
8.2.1 Learning motive and strategy scores 117
8.2.2 Learning approach and composite scores 120
8.2.3 Correlational analyses 122
8.2.4 Hierarchical regression analysis 124
8.3 General discussion 125
8.3.1 Relation between reading ability and learning approaches 125
8.3.2 Metacognition in reading and metacognition in learning 126

9. STUDY 3: ERROR DETECTION TASK 128
9.1 Method 128
9.1.1 Subjects 128
9.1.2 Materials 128
7.1.3 Equipment and software 131
7.1.4 Procedure 132
9.2 Data Scoring, Results and discussion 134
9.2.1 Content Knowledge and Comprehension Performance 134
9.2.2 Analyses of Monitoring Processes (Evaluations) 136
9.2.3 Analyses of Monitoring Strategies (Regulations) 149
9.2.4 Analyses of Motivational Beliefs (Attributions) 151
9.3 General discussion 160
9.3.1 Research Findings Synthesized 160
9.3.2 Research Paradigm Reexamined 165
9.3.3 Issues for future research 166

10. EXPLORING THE RELATIONS AMONG COMPREHENSION MONITORING COMPONENTS AND READING PERFORMANCE 170
10.1 Statistical Considerations 170
10.2 The Model 171
10.2.1 Structure of the Model 171
10.2.2 Measures of Model Components 173
10.2.3 Factor Scores of Model components 175
10.2.4 Analysis of the Model 178
10.3 Results and Discussion 179
10.3.1 Effects on Comprehension Performance 180
10.3.2 Effects on Strategy Use 181
10.3.3 Effects on Monitoring Process 182
10.3.4 Effects on Metacognitive Knowledge 183
10.3.5 Effects on Goal/Motive 183
10.4 General Discussion 183
10.4.1 Research Findings Synthesized and Reinspected 184
10.4.2 Implications for Model Development 186
10.4.3 Implications for Educational Applications 188

PART THREE: INTEGRATION 189

11. COMPREHENSION MONITORING: ANSWERED AND UNANSWERED QUESTIONS 190
11.1 Research Questions Answered 190
11.2 Some Unresolved Issues 195
11.2.1 Measurement Issues 195
11.2.2 Conceptual Issues 197
11.3 Chapter Summary 199

REFERENCES 200

APPENDICES 215

PART ONE:
THEORETICAL AND EMPIRICAL ISSUES

1. INTRODUCTION

> *One of the challenges to theorists and researchers interested in metacognitive and executive control problems is to lend clarity and precision, through careful thinking and diligent empirical work ..., before "fuzzy" concepts become still fuzzier amidst unbridled application of these currently popular ideas.*
>
> *-- Garner, 1987, p. 30*

Reading has always been a major concern of psychologists and educators who view it as an important tool for academic attainment as well as for survival in everyday life situations (Calamai, 1987; Downing & Leong, 1982; Gibson & Levin, 1975; Huey, 1908/1968). As Resnick (1981) has observed, reading is the instructional area "to which psychologists have attended for the longest time and in the greatest numbers"(p. 661).

While the study of reading has undergone a multitude of changes over the decades, contemporary interest in how the reader directs his/her own cognitive resources to complete the reading task is largely influenced by recent developments in cognitive psychology. A number of cognitive psychologists (e.g., Brown, 1980; Flavell, 1979) have postulated that metacognition, referring to one's knowledge of and control of his/her own cognitive activities, plays a vital role in reading. They argue that reading involves the planning, checking and evaluating activities subsumed under the notion of metacognition and that effective readers must have some awareness and control of these cognitive activities as they engage in the reading process. Such a postulation points to the need for research that focuses on the development of awareness in readers of their own cognitive mechanisms and the role these mechanisms play in the reading process. Numerous studies on metacognitive aspects of reading carried out in recent years reflect this direction (see, for example, reviews by Baker & Brown, 1984b; Garner, 1987; Paris, Wasik, & van der Westhuizen, 1988) .

The notion of comprehension monitoring comes out of the recent research on metacognition. Whereas cognitive monitoring is one component of metacognition concerning the knowledge and use of self-regulatory mechanisms in general, comprehension monitoring denotes cognitive monitoring in reading. Viewed from a global perspective of cognitive monitoring as proposed by Flavell (1981), comprehension monitoring involves at least four components: metacognitive knowledge, monitoring process, strategy use, and goals and motives. Essentially, comprehension monitoring refers to one's intention, knowledge, and ability to keep track of his/her understanding, and to detect and repair comprehension difficulties if necessary.

Historically speaking, the awareness of the importance of comprehension monitoring to successful reading has early antecedents in psychology and in educational writing. For instance, Dewey's (1910) call for reflective thinking was essentially a system of inducing cognitive monitoring which would result in critical reasoning and comprehension. Also, Huey (1908/1968) and Thorndike (1917) argued that reading entails understanding and monitoring activities (cf. Baker & Brown, 1984b). In the educational context, Holt (1964), in his bestselling book on "how children fail", contended that "part of being a good student is learning to be aware of one's own mind and the degree of one's own understanding. The good student may be one who often says that he does not understand, simply because he keeps constant check on his understanding" (p. 8). Describing reading as a "psycholinguistic guessing game", Goodman (1976) stated that the reader must monitor his/her understanding in order to formulate hypotheses about the text. More recently, Markman (1985) has claimed that the ability to differentiate what is understood from what requires clarification is necessary for academic excellence. In brief, the theoretical position that comprehension monitoring is crucial to effective reading appears to be supported by many reading theorists and educators.

Such a theoretical position has also gained support from empirical research. The majority of the research into comprehension monitoring has revealed that reading proficiency is associated with skills of comprehension monitoring. Compared to skilled readers, less skilled readers appear to be less aware that they must make sense of what they read (Canney & Winograd, 1979; Garner, 1981; Myers & Paris, 1978). Additionally, they are less able to evaluate their understanding during reading and to implement regulation and correction strategies when confronting comprehension problems (August, Flavell, & Clift, 1984; Garner & Kraus, 1981-1982; Zabrucky, Moore, & Ratner, 1985). In summary, the general pattern of the results of this body of research suggests that less skilled readers do not monitor their comprehension as effectively as do skilled readers.

In spite of the apparent strength of the above theoretical arguments and empirical findings, a number of conceptual and methodological issues in this area of research remain to be resolved. First, most studies have operationalized comprehension monitoring as a unidimensional process; few studies have been grounded in a solid theoretical framework which conceptualizes comprehension monitoring as a multidimensional construct. If we accept the notion of comprehension monitoring as described earlier, comprehension monitoring includes knowledge, evaluation, regulation, and intention components. Studies that investigate only one or two aspects of comprehension monitoring may not provide adequate and comprehensive information concerning comprehension monitoring skills among various kinds of readers. Furthermore, controversy exists about the methods used to measure comprehension monitoring. Previous studies have indicated that there are weaknesses inherent in the two frequently used research paradigms in comprehension monitoring studies (Winograd & Johnston, 1982). Whereas the shortcomings of the error-detection paradigm involve confounding variables and ambiguous evaluation standards, the validity of interview reports and protocol analysis is questionable. Considerable changes are needed if these methods are to continue to be used in comprehension monitoring research.

The present research attempts to deal with the above issues and is distinguished from previous studies in a number of ways. First, following the work of the pioneers (i.e., Flavell, Brown) in the area, a model of comprehension monitoring in which comprehension monitoring is conceptualized as a multidimensional construct is proposed. Specifically, comprehension monitoring is defined as cognitive monitoring in reading and is comprised of four dimensions: knowledge, process, strategy, and goal/motive and motivational factors. Based on this theoretical framework, three research studies using multiple dependent measures are developed to obtain converging data about comprehension monitoring and reading performance. In particular, the first two research studies, in which interviews and questionnaires were employed, were designed to examine the knowledge and goal/motive aspects of comprehension monitoring. The final research study, in which an error detection task was employed, attempted to investigate the process and strategy dimensions and attributional beliefs related to comprehension monitoring. It is hoped that the present research meets the challenges of metacognitive research, as Garner (1987) notes, in clarifying the conceptual fuzziness of metacognition and comprehension monitoring through a scrupulous theoretical inquiry and a careful empirical investigation.

The report of the research is organized into three parts. Part One discusses theoretical and empirical issues pertinent to the research. The first four chapters constitute this part. The present chapter places the study in the context of recent research development in education and psychology. Chapter 2 examines relevant theoretical issues thereby establishing a hypothesized model of comprehension monitoring for the research. Chapter 3 highlights related empirical studies of comprehension monitoring along the dimensions of age and reading proficiency. Chapter 4 addresses major methodological issues. These four chapters together provide theoretical and research background information on comprehension monitoring and lead to the need for the present research which is described in Part Two. The subsequent six chapters make up the second part. Chapter 5 details the rationale and research questions of the investigation. Chapter 6 outlines the overall design of the research which consists of three related studies. The next three chapters describe procedures and findings of each study. Chapter 10 reports the path analysis results of the hypothesized model of comprehension monitoring using data obtained from the three studies. Part Three contains the final chapter, Chapter 11. This concluding chapter summarizes major findings pertaining to the research questions of the investigation and discusses some unresolved issues for future research.

2. THEORETICAL FRAMEWORK

In this chapter, current theories of reading comprehension relevant to the theoretical position of the present research are first outlined. Conceptual notions of cognition, metacognition, and cognitive monitoring are then examined. Comprehension monitoring, as cognitive monitoring in reading, is analyzed within the framework of cognitive monitoring and its relationship to reading proficiency is also discussed. Finally, a multidimensional model of comprehension monitoring, derived from Flavell's (1981) model of cognitive monitoring, is proposed and serves as the theoretical framework for the present research.

2.1 Current Theories of Reading Comprehension

In this section, several current theories of reading comprehension are presented, serving as a theoretical basis for examining the role of metacognition, and comprehension monitoring in particular, in reading.

2.1.1 Reading as Information Processing

Using the computer metaphor, reading psychologists have attempted to conceptualize the reading process from the perspective of information processing. Within this framework, a number of reading theories have been developed. These theories all have in common a view of the reading process as a series of processing states that occur between symbols and meaning. The major distinction centers around the question of whether reading is regarded as a top-down or a bottom-up processing activity. Top-down models conceive of reading as mainly a concept-driven process. In contrast, bottom-up models assume reading is primarily a stimulus-driven process (Downing & Leong, 1982). Whereas these two types of model have focused on analysis of component processes of reading in one direction, interactive models, which allow both bottom-up and top-down processing, emphasize the interactive nature of the components (Stanovich, 1980). These three types of model will be described as follows.

For top-down theorists, the direction of processing is from the cognition system downward to the data of print. The reader acts like a hypothesis tester, using his/her conceptual and linguistic knowledge to form hypotheses about what is being read and sampling textual information to confirm or reject the hypotheses. This conceptually driven process of reading has been strongly emphasized by Goodman (1970, 1976) and Smith (1979, 1982).

Goodman (1970) described reading as a "psycholinguistic guessing game" requiring the reader to interrelate language and thought in an effort to reconstruct the author's written message. Smith (1979, 1982) held a similar view to that of Goodman in that reading is essentially a process of hypothesis testing. Whereas Goodman described reading as a "psycholinguistic guessing game", Smith (1979) asserted that "reading is asking questions of printed text" (p. 105). To these top-down theorists, the basic skill of reading lies more in the reader's conceptual knowledge rather than in identification of elements of print. Reading subprocesses at the lower levels are deemphasized.

For bottom-up theorists, the direction of processing is from analyzing data up to meaning. The reader is viewed as an analytic processor of print, making use of perceptual, phonological and morphological analysis to generate meaning from text. This stimulus-driven process of reading is stressed by Gough (1972; Gough & Cosky, 1977), and LaBerge and Samuels (1974).

According to Gough (1972), the reading process is strictly bottom up, from lower-level sensory analysis to higher-level syntactic-semantic encodings. That is, reading is a serial-stage process of letter-by-letter, word-by-word, sentence-by-sentence analysis of print. While the LaBerge and Samuels (1974) model has the general characteristics of serial-stage theory just like that of Gough, what makes it distinct from Gough's model is its emphasis on the role of attention and the notion of automaticity in reading. Samuels (1977) contended that reading can be viewed as a two-step process consisting of a lower-level task -- decoding, and a higher-level task -- comprehension. If the individual's capacity for attention is limited and decoding consumes too much attention, there will not be enough attention available for comprehension. On the contrary, if the decoding process requires very little attention, the bulk of the attentional resources can be used for comprehension. In other words, the faster and more automatically that the lower-level processes can be processed, the more attention is made available to accomplish the higher-level comprehension process. The importance of automaticity in reading, thus, represents the primary characteristic of the LaBerge and Samuels model.

In short, both the Gough model and the LaBerge and Samuels model are typically bottom-up processing oriented. They view discriminant analysis of letters, letter groups, and words, as primary in the reading process, although they also recognize the contribution of higher-level subskills to fluent reading.

Today, however, neither bottom-up models nor top-down models are considered to be adequate in conceptualizing the reading process in that these two types of model appear to offer dichotomous descriptions of the reading process. While top-down models necessarily move from the higher to lower levels of the processing sequence and neglect the constraints of lower-level analyses to higher-level processes, bottom-up models imperatively begin from the lower to higher levels of the processing hierarchy and fail to account for the impact of contextual processing on lower-level analyses (Rumelhart, 1977; Stanovich, 1980). In view of the deficiencies of strictly top-down and bottom-up models, a third class of theory emphasizing the interactive nature of the component skills in reading has emerged.

Interactive models differ from top-down or bottom-up models primarily in terms of the executive control of processing. For interactive theorists, reading is not necessarily a linear process. The executive control of processing, therefore, is neither top-down nor bottom-up. Rather, "data-driven, bottom-up processing combines with top-down, conceptually driven processing to cooperatively determine the most likely interpretation of the input" (Rumelhart & McClelland, 1981, p. 37). This interactive aspect of reading is emphasized by Rumelhart (1977), Lesgold and Perfetti (1978), and Stanovich (1980).

Based on language processing by computer, Rumelhart (1977) outlined a reading model which allows parallel and interactive processing units. To him, reading is interactive because different levels of processing are responsible for providing information and sharing the information with other levels. Comprehension is thus the process of synthesizing information provided concurrently from all levels.

Consistent with the assumption that reading is interactive, Perfetti and Lesgold (1977, 1979; Perfetti, 1985) developed a model of reading skill emphasizing verbal efficiency. To illustrate the need for an interactive view of the reading process, Lesgold and Perfetti (1978) described bottom-up theorists as surgeons and top-down theorists as internists:

> The bottom-up view, more surgical, traces the flow of coding information between connected components. The top-down view, more medical, concentrates on the higher-level goals of reading. Both viewpoints are needed, but both must proceed from a common general interactive model of the reading process. (p. 325)

In discussing the exact sources of ability differences in reading, Perfetti (1985) hypothesized that linguistic processes concerning orthographic patterns and speech components may be involved. He postulated that speech processes may play a significant role in reading and thus argued for verbal coding as an essential part of a model of skilled reading. At the same time, Perfetti also acknowledged the importance of higher-level cognitive structures such as schemata for comprehension.

While acknowledging that Rumelhart (1977) provided the best example of an interactive model, Stanovich (1980) further suggested a compensatory-interactive model based on Rumelhart's proposal:

> A compensatory-interactive model of processing hypothesizes that a pattern is synthesized based on information provided simultaneously from all knowledge sources and that a process at any level can compensate for deficiencies at any other level. (p. 262)

According to Stanovich (1980), the reader extracts meaning from text based on information provided simultaneously from several knowledge sources. When word identification is inefficient, the reader may draw from higher-level knowledge sources to aid recognition. However, while this kind of compensatory use of contextual information may facilitate performance at the word level, it will deplete the cognitive resources available to integrative text-level processes, and therefore eventually the comprehension of the reader may suffer. By presenting a thorough review of the research literature on individual differences in reading, Stanovich (1980) argued that the interactive-compensatory model best accounts for much research evidence disclosing a pattern of poor word recognition skills, use of context to facilitate word recognition, and poor comprehension on the part of the less-skilled reader.

In sum, information processing models of reading comprehension differ in the extent to which they view the direction of cognitive processes. Strictly top-down or bottom-up models are now seen as inadequate in conceptualizing the reading process. It appears that reading is best characterized as an interactive process involving both top-down and bottom-up analyses. This interactive view of reading implies that, to accomplish comprehension, the reader must be an active processor of information who is in charge of his/her cognitive resources in processing both bottom-up and top-down information. In other words, a successful reader cannot simply process textual information in a passive manner but makes active cognitive efforts to synthesize information from various levels of sources. It is this active role of the reader implied in current information processing theories of reading that leads us to further explore the constructive process of reading in which the reader plays the role of a schema constructor/reconstructor.

2.1.2 Reading as Schema Building

The central thesis of the current formulations of schema theory of reading is that "comprehension is a matter of activating or constructing a schema that provides a coherent explanation of objects and events mentioned in a discourse" (R. C. Anderson, 1984,

p. 247). According to schema theorists, comprehension occurs when the reader evolves a schema or a set of schemata that explains the message as a whole.

What, then, is a schema? According to Rumelhart and Ortony (1977), the old notion of a schema can be traced back to the work of Kant (1787/1963) in which the term is used to signify cognitive structure for realizing knowledge or experience. Piaget (1926) and Bartlett (1932) are credited with introducing the notion to the field of psychology (Downing & Leong, 1982). For these pioneers, schemata are "the building blocks of cognition", the elements essential for all information processing (Rumelhart, 1980, p. 33). More recently, schemata are conceived as data structures representing generic concepts stored in memory (Rumelhart & Ortony, 1977). Adams and Collins (1979) have defined a schema as a description of a class of concepts composed of a hierarchy of schemata in which the top level representation provides a conceptual frame for all members of the class. In brief, schema denotes knowledge structure and schema theory is fundamentally a theory about how knowledge or meaning is represented in the human mind (Rumelhart, 1980). Relating the concept to the psychology of reading, a schema account of reading is then a theoretical formulation about how meaning is extracted from written text. A schema or a cluster of schemata can be viewed as a set of expectations or hypotheses that guide understanding of text information (Garner, 1987). Specifically, R. C. Anderson (1985, p. 376) proposed six functions of schemata in reading. He suggested that schemata provide a basis for (1) assimilating text information, (2) allocating attention to significant text information, (3) making inferential elaborations of implicit messages, (4) searching memory in an orderly manner, (5) summarizing important text information, and (6) making inferential reconstruction of an original message in the case of missing information in memory. Within the schematic viewpoint of reading, comprehension is thus a process of activating old schemata (i.e., retrieving prior knowledge), modifying existing schemata (i.e., refining acquired knowledge), and/or developing new schemata (i.e., acquiring new knowledge) to achieve understanding of the text.

Furthermore, two types of schemata can be differentiated when the notion is applied to the reading process. First, there are "content schemata" referring to the reader's knowledge of the world (e.g., knowledge of objects and events). Second, the reader also has "textual schemata" denoting knowledge of discourse conventions (e.g., "story grammars") (Garner, 1987). Both types of schemata play a vital role in guiding the reader to process the text and achieve comprehension.

At this point, it can be seen that schema theory does share many ideas with most top-down models on emphasizing the role of conceptual knowledge in reading. Both theories view reading as a process of schema building or hypothesis testing. The reader constructs schemata or hypotheses about the most reasonable interpretation of the text while reading. As more information is obtained, schemata or hypotheses can be confirmed, rejected, modified or reconstructed. The reader's conceptual knowledge consistently forms the basis for building schemata or hypotheses about what is being read. While it is agreed that schema theory holds a similar stance to that of top-down models in viewing conceptual knowledge as crucial to comprehension, it would be erroneous to include schema theory within the family of strictly top-down models because the theory does not imply that reading is a linear processing sequence necessarily moving from higher to lower levels. On the contrary, schema theory is consonant with the interactive notion of reading proposed by information-processing theorists because in schema-directing processing, activation goes in both bottom-up and top-down directions (Rumelhart, 1980).

In fact, as the advocates of a schema-theoretic view of reading, Adams and Collins (1979) claimed that "schema theory for the first time provides a structure powerful enough to support the interactions among different levels of processing in reading" (p. 3). The goal of schema theory, according to these authors, therefore, "is to specify the interface between the reader and the text -- to specify how the reader's knowledge interacts and shapes the information on the page and to specify how that knowledge must be organized to support the interaction" (p. 3).

By assuming that schemata exist at all levels of processing and that lower level schemata are subschemata within high level schemata, Adams and Collins (1979) further explained the coordinated activity of schemata at different levels of analysis. Using Aesop's Fable, "Stone Soup", as an example, the authors suggested that comprehending the passage involves both bottom-up and top-down processing. Bottom-up processing includes schemata at letter, word, and syntactic levels. Top-down processing includes schemata at syntactic and semantic levels, and schemata at interpretive levels such as problem solving schemata for goals and the fable schemata for the moral of the story. As top-down and bottom-up processes operate concurrently at all levels of abstraction, they work to synthesize the various parts of information into a coherent whole. Comprehension, consequently, is dependent on "the readers' ability to appropriately interrelate their knowledge and the textual information both within and between levels of analysis" (Adams & Collins, 1979, p. 20).

2.1.3 From Reading Theories to Metacognitive Literature

It is clear, in the preceding discussion, that most information-processing theorists consider reading to be an interactive process involving both data-driven and concept-driven processing. The reader is viewed as an active processor of information rather than as a passive reactor to stimuli of print. Moreover, proponents of schema theory characterize reading as a constructive process in which the reader generates, modifies and reconstructs expectations while interacting with the text. These theorists' descriptions of the reading process convergingly suggest that reading is a complex cognitive task requiring the reader's active participation. Their conceptions of reading comprehension place the reader at the center of the cognitive enterprise. The reader is, implicitly or explicitly, portrayed as an active agent who regulates his/her own cognitive resources to extract meaning from text. Emphasis upon a highly active and constructive reader implies that the way the reader coordinates his/her cognitive processing activities is crucial to effective comprehension. Metacognition, accordingly, is deemed to play a critical role in reading. However, before the relationship between metacognition and reading can be delineated, it seems necessary to examine in some detail the notions of cognition, metacognition, and some other related concepts as well.

2.2 Cognition and Metacognition

An analysis of the notion of metacognition logically includes an analysis of the notion of cognition. Indeed, the study of human cognition is one of the most influential trends in the field of psychology today. In this context, it is interesting to note how behaviorist Skinner (1987) has described this phenomenon:

> A curve showing the appearance of the word *cognitive* in the psychological literature would be interesting. A first rise could probably be seen around 1960; the subsequent acceleration would be exponential. Is there any field of psychology today in which something does not seem to be gained by adding that charming adjective to the occasional noun? (p. 783)

Despite the widespread use of the term, to find a clear and unanimous definition of cognition has proven to be a difficult task (Forrest-Pressley & Waller, 1984). The traditional image of cognition seems to be related to a narrow range of "intellectual" processes such as reasoning, inferring, conceptualizing, symbolizing, and problem solving (Flavell, 1985, p. 2). Most contemporary psychologists, however, tend to broaden the view of cognition beyond the classical higher mental processes. A sampling of several texts in the field of cognitive psychology reveals that:

> ... the term "cognition" refers to all the processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used. (Neisser, 1967, p. 4)

> Cognitive psychology is the science of human information processing. Its subject matter, often called cognition, concerns the kind of information we have in our memories and the processes involved in acquiring, retaining, and using that information. (Wessells, 1982, pp.1-2)
>
> ... cognition refers to knowledge and thought. More specifically, it refers to processes associated with the acquisition, organization, retention, and use of knowledge. (Gross, 1985, p. 3)

From the above statements, it can be seen that although there appears to be some inconsistencies among these psychologists in defining the term, cognition has usually been broadly viewed as mental processes that enable the acquisition, retention, access and use of knowledge. Given such a loose definition, cognition embraces a wide scope of psychological entities ranging from perception, attention, memory, to concept formation, comprehension, problem-solving, to social judgement and reasoning, and so forth. Flavell (1985) argued that it is neither possible nor desirable to define cognition in a precise or inflexible manner because cognitive processes frequently intrude themselves into most of the human psychological processes and activities. Earlier, Neisser (1967) had offered a similar view by stating that cognition is involved in almost every human activity and that every psychological phenomenon is more or less a cognitive phenomenon.

While the need for a broad and complex conception of cognition is recognized, for the purposes of the present study, the discussion of cognition in the rest of this dissertation will be concentrated on what might be called "academic cognition" referring to cognitive processes involved in academic learning situations (Brown, Bransford, Ferrara, & Campione, 1983). Although it is commonly agreed that academic cognition usually involves effort, whether it is relatively "isolated and cold", as Brown et al. (1983, p. 78) suggested, is debatable. Recent research into this area appears to indicate that academic learning is rarely isolated and unemotional (Carr, Borkowski, & Maxwell, 1991; Paris & Winograd, 1990). Moreover, it should be noted that Brown and her associates also acknowledged the effects of emotional and social factors on academic learning. Thus, without denying the social, motivational and emotional aspects of academic learning, here the use of the term "academic cognition" is to focus our discussion primarily on cognitive processes related to school-type learning. Within this view, cognition hereafter refers to effortful acquisition, retention, and use of academic knowledge. Accordingly, such terms as learning, remembering, understanding, and problem-solving in academic context can be subsumed under the notion of cognition.

If cognition involves learning, remembering and understanding, then metacognition involves thinking about one's own learning, remembering and understanding. Using metacognition as the superordinate term, these various forms of metacognition can be labelled as metalearning, metamemory and metacomprehension (Garner, 1987), with the *meta* prefix referring to reflection and control of cognitive processes (Lawson, 1984). While metacognition essentially means "cognition about cognition", it has been described as a somewhat fuzzy concept due to various referents of the term in the literature (Brown, 1987; Flavell, 1981; Garner, 1987; Paris, Wasik, & van der Westhuizen, 1988).

2.3 Conceptual Issues of Metacognition

As pointed out by Brown et al. (1983), two primary problems associated with the term metacognition are: (1) the development of the concept in two different research traditions, and (2) the separability of metacognition and cognition. Can these problems be resolved? The following analysis attempts to provide tentative conclusions drawn from the literature.

2.3.1 Historical Roots

Although metacognition is a relatively new term, historical roots of the notion can be traced back to the turn of the century. Brown (1981), for instance, refers to the works of Dewey (1910), Huey (1908/1968) and Thorndike (1917) on reflective reasoning and planning as early antecedents of current metacognitive theories. Some other psychologists (e.g., James, 1890, quoted in Reeve & Brown, 1985; Baldwin, 1909, quoted in Fry & Lupart, 1987) have also been cited in the same vein. These scholars' ideas of reflective thinking in learning, however, have been buried for the most part of the century (Fry & Lupart, 1987). Initially influenced by Piagetian developmental theory, Flavell has been credited with rediscovering the importance of self-reflection in learning and introducing the term metacognition to denote these processes (Reeve & Brown, 1985). Following Flavell's pioneering research (e.g., Kreutzer, Leonard, & Flavell, 1975) concerning children's metamemory, cognitive developmental psychologists became interested in investigating children's awareness of their own learning processes in various areas (e.g., Myers & Paris, 1978; Miller & Bigi, 1979). Implicit in this research trend of metacognition is the view that control of cognitive processing is in a large part dependent upon one's metacognitive knowledge and the ability to reflect upon that knowledge (Reeve & Brown, 1985). As a result, within this research tradition, the self-awareness aspect of metacognition (i.e., knowledge of cognition) was examined extensively in the later part of the past decade.

Contemporaneous with this area of work, information-processing psychologists began to emphasize the importance of "executive control" of cognitive activities. As Reeve and Brown (1985) noted:

> Common to most information-processing models is the notion that the activities of the system are guided by the operations of a control executive, the function of which is to oversee and guide problem solving. Some of the functions attributed to the executive include planning, monitoring, checking, and regulating problem-solving behavior ... . It is the self-regulating activities of the cognitive system that have been referred to as metacognitive processes. (pp.346-347)

Representatives of this approach to human cognition were the studies of Brown (e.g., Brown, 1974; Campione & Brown, 1977), and Sternberg (e.g., Sternberg, 1984), among others (see, for example, reviews by Brown et al., 1983, Garner, 1987). Embedded in this line of inquiry is the assumption that self-regulatory functions are essential for learning and are key mechanisms of growth and change. These functions have been described as regulation of cognition (Brown, 1978), control of cognition (e.g., Lawson, 1984), executive processes (e.g., Cavanaugh & Perlmutter, 1982; Lawson, 1984), metacomponents (e.g., Sternberg, 1984), and metaprocessing (e.g., Belmont, Butterfield, & Ferretti, 1982). In short, the self-control aspect of metacognition (i.e., regulation of cognition) has received much attention in this area of research.

Put together, it can be seen that the concept of metacognition has its modern origin in two distinct research traditions. The knowledge emphasis of metacognition grew out of traditional developmental psychology originated from Piaget. The executive-control emphasis of metacognition is grounded in information-processing psychology with the computer analogy for mind. Despite different historical origins, there is conceptual overlap between the two areas of work. For example, both stress the use of strategies by learners and the importance of cognitive monitoring towards goals (Garner, 1987). While there are some researchers (e.g., Cavanaugh & Pertmutter, 1982; Lawson, 1984) advocating the use of the term metacognition be strictly limited to metacognitive knowledge, it appears that psychologists from both areas have made substantial efforts to incorporate both elements into their current conceptualization of metacognition. Flavell (1981), for instance, has extended his definition of metacognition to include "metacognitive knowledge" as well as "metacognitive experience". Brown (1981) has also differentiated metacognition into two components: "knowledge about cognition" and "regulation of cognition". As Garner (1987) has observed, applied researchers and educators in recent years are inclined to talk about both knowledge-of-cognition and control-of-cognition dimensions of metacognition, showing less concern for ancestry but greater concern for implications for instruction. In line with Garner's view, Paris and Winograd (1990) have recently proposed to use the terms "cognitive self-appraisal" and "cognitive self-management" to capture these two essential aspects of metacognition. With these definitional clarifications (i.e., metacognition refers to both knowledge *and* control of cognition), then, it seems that many disputes which have appeared in the literature could be settled. Table 2-1 illustrates conceptualizations of metacognition by researchers of different research traditions.

Table 2-1 Conceptualizations of metacognition

	conceptualization of metacognition	
researcher(s)	emphasis of self-awareness	emphasis of executive-control
Flavell (1981)	metacognitive knowledge	metacognitive experience
Brown (1981)	knowledge about cognition	regulation of cognition
Cavanaugh & Permutter (1982)	metacognitive knowledge	executive processes
Belmont et al. (1982)		metaprocessing
Sternberg (1984)		metacomponents
Lawson (1984)	metacognitive knowledge	control of cognition
Pairs & Winograd (1990)	cognitive self-apprasial	cognitive self-management

2.3.2 Construct Validity

There is another source of confusion concerning the use of the term metacognition as to whether metacognition is separable from cognition. As pointed out by Brown (1978), many psychologists and educators have wondered if metacognition is merely a set of cognitive functions "elevated and dignified with a new title" (p. 79). Such a view reflects a major problem of the metacognition construct in that it is very difficult to distinguish metacognition from cognition. Earlier, Schmidt (1973) defined cognition as "any activity of becoming or being aware of something or having an object of consciousness" (p. 106), highlighting the consciousness aspect of cognition which may be termed metacognition. A decade later, Kirby (1984) proposed a general model of cognition which consists of performance components and control components. Performance components refer to processes involved in the actual encoding, transforming and storing of information, whereas control components are strategies concerned with the control of these processes. The control components in the Kirby model, to a large extent, could also be labelled as metacomponents subsumed under the notion of metacognition. These psychologists' conceptions of cognition thus led French (1985) to speculate that "the notion of metacognition is really not separate from cognition but at one end of the continuum of cognitive experience/development within a dynamic and broad definition of cognition" (p. 15).

Viewing metacognition as at one end of the continuum of cognitive experience may be one way of conceptualizing the relationship between metacognition and cognition. Further analysis, however, reveals the validity of metacognition as a construct distinct from cognition.

The position that metacognitive processes are separate from cognitive processes is supported by Lawson (1984). According to Lawson, metacognitive knowledge results from reflection of one's own cognitive activity. Since such reflection takes cognitive activity as its object, it should be logically distinct from the stream of cognition. Also, executive processes are conceived as higher-level processes because of their controlling role in cognition. Although Lawson advocated the term metacognition be applied only to metacognitive knowledge, he maintained that both metacognitive knowledge and executive processes are higher-level processes distinct from cognitive processes.

Similarly, Slife, Weiss, and Bell (1985) succinctly argued for the independence of metacognition as a theoretical construct. They contended:

> The very notion of a meta process implies a phenomenon apart from cognitive processes often presumed to develop it. Although the knowledge-about-cognition component of metacognition relies on some information acquisition such as mnemonic strategies, it is clear that its function as observer of thought requires a position outside the flow of cognition. The self-regulation component of metacognition seems to differ from cognitive activities by definition. The monitoring and checking activities that regulate the process of these acquisitions necessitates some independence from them. (pp.437-438)

Following this line of analysis, it appears that metacognition as an independent construct is at least theoretically sound. Is there any empirical evidence supporting its validity?

Slife et al. (1985) went further to test the separability of metacognition and cognition by measuring the effects of metacognitive skills in problem-solving, with relevant cognitive factors being held constant. The results showed that, despite matching learning disabled elementary students with regular students on intelligence, mathematical knowledge and performance, the LD subjects were less skilled in terms of metacognitive knowledge and monitoring skills related to problem-solving. Hence, the influence of metacognitive differences were demonstrated apart from factors related to cognition, indicating metacognitive functions as a separate set of skills. The researchers concluded that their study has provided evidence for the construct validity of metacognition. In other words, metacognition cannot be reduced to cognition.

Other research studies also attempted to provide empirical support for the separability of cognition and metacognition. For example, Montague (1992) examined the effects of cognitive and metacognitive strategy instruction on learning disable adolescents' mathematical problem solving performance. In treatment 1, subjects received either cognitive or metacognitive strategy instruction whereas in treatment 2, subjects received both cognitive and metacognitive strategy instruction. Montague concluded that cognitive and metacognitive strategy instruction appeared to be more effective than either cognitive or metacognitive strategy instruction alone. As a discussant of this research study, Hutchinson (1992) argued that, while Montague had demonstrated the complementary function of cognitive and metacogntive instruction in contributing to learning, the researcher did not identify separate cognitive or metacognitve components critical to the effectiveness of the instruction. Since Montague described metacognition within the context of cognition, with cognition and metacognition occuring simultaneously during problem solving, the discussant commented, it was difficult to interpret Montague's findings about the relative contributions of cognitive and metacognitive components. Hutchinson pointed out that a macro level analysis of cognitive and metacognitive processing, each of which consists of a number of micro processes, was deemed to be extremely difficult if not impossible. However, Hutchinson did suggest that a micro level of analysis focusing on specific cogntive or metacognitive components (e.g., rehearsal, modeling, etc.) would be more feasible and practical in identifying essential cognitive and/or metacognitive components of process instruction.

In light of the above discussion, it is suggested that metacognition as a construct separate from cognition is theoretically valid and empirically, in spite of difficulty, verifiable. Of course, as Slife et al. (1985) and Montague (1992) noted, the separability between metacognition and cognition does not preclude their constant interaction. In other words, metacognitive functions should be viewed as processes interactive, but not equivalent, with cognitive processes.

2.4 Cognitive Monitoring: A Fundamental Form of Metacognition

With definitional controversies of metacognition clarified and its construct validity demonstrated, it seems now appropriate to examine the relationship between metacognition and cognitive monitoring. Whereas metacognition as previously discussed refers to one's knowledge and control of his/her own cognitive system in general, cognitive monitoring concerns one's ability to evaluate his/her current cognitive state while performing cognitive tasks. Cognitive monitoring, accordingly, could be viewed as one fundamental form of metacognition and it is primarily related to the knowledge and use of self-regulatory mechanisms in cognitive processing. While many theorists and researchers have contributed to the current conceptualization of metacognition and cognitive monitoring, the works of Flavell and Brown and their associates have been regarded as most comprehensive and significant to this end (Fry & Lupart, 1987). Flavell (1981, 1984) has suggested a global model of cognitive monitoring which is comprised of four aspects: metacognitive knowledge, metacognitive experience, cognitive actions, and cognitive goals. These four aspects will be discussed and synthesized with the viewpoints proposed by Brown, and integrated with recent research efforts to link metacognition with motivation (e.g., Borkowski, Carr, Rellinger, & Pressley, 1990; Paris & Oka, 1986; Paris & Winograd, 1990; Weinert, 1987;).

2.4.1 Knowledge

Knowledge about cognitive monitoring is an important component in Flavell's model of cognitive monitoring; it is one type of metacognitive knowledge. According to Flavell (1984), metacognitive knowledge refers to one's "accumulated declarative and procedural knowledge concerning cognitive matters, and can be divided into three categories: person, task, and strategy" (p. 4).

Knowledge of person variables refers to one's knowledge and beliefs about human beings as cognitive processors. It can be further subcategorized into knowledge and beliefs about cognitive differences within an individual and between individuals, and cognitive similarities among all human beings. Flavell (1981) labels these three subcategories as information about intraindividual differences (e.g., I am better at social studies than music), inter-individual differences (e.g., John is not as proficient as Mary at completing math. assignments) and universals (e.g., human beings' short-term memory is of limited capacity).

Knowledge of task variables is concerned with the nature of the information in a cognitive task (e.g., familiar, unfamiliar, simple, complex, etc.) and the nature of the task demands (e.g., to recall the gist of a story is easier than to recite it word for word).

Through knowledge of task variables, one learns that various tasks may require different processing procedures.

The third category, knowledge of strategy variables, refers to one's stored knowledge about the nature and usefulness of certain cognitive actions or metacognitive procedures which can be utilized to achieve various cognitive goals (e.g., problem-solving, comprehension).

Flavell (1981, 1984) pointed out that person, task, and strategy variables are highly interactive. The following example (adapted from Garner, 1987) illustrates how these three categories of metacognitive knowledge might interact: John knows that he tends to read with a global processing approach (person variables) and that the next week's test for social studies will be a detail-oriented test (task variable); as a result he decides to use a note-taking strategy emphasizing details to prepare for the test (strategy variable).

Flavell's conception of metacognitive knowledge is somewhat correspondent to what Brown (1978; Baker & Brown, 1984a,b) labeled as "knowledge about cognition". According to Baker and Brown (1984b), knowledge about cognition is one component of metacognition consisting of "a person's knowledge about his or her own cognitive resources and the compatibility between the person as a learner and the learner situation" (p. 353). This knowledge, the authors contended, is relatively statable and stable in that, first, the individual is able to reflect and discuss his/her own cognitive processes, and second, the result of this reflection becomes part of the individual's knowledge base.

Paris, Lipson, and Wixson (1983), on the other hand, described metacognitive knowledge in terms of declarative, procedural, and conditional knowledge. Declarative knowledge includes proposition about task characteristics and personal abilities. Procedural knowledge includes information about how to execute various actions. While Paris et al. (1983) described declarative and procedural knowledge in a way comparable to Flavell's accounts of person, task, and strategy variables, they claimed that declarative and procedural knowledge alone are not sufficient to ensure strategic behavior. One must also have conditional knowledge to become a strategic learner. In their view, conditional knowledge specifies the circumstances of application of procedures. In short, declarative knowledge reveals *what* one knows and procedural knowledge indicates *how* one thinks, whereas conditional knowledge answers questions about *when* and *why* to apply knowledge or strategies.

The descriptions of metacognitive knowledge offered by the above researchers may be slightly different from one another. However, they have in common a view of metacognitive knowledge as an individual's reflection or analysis of his/her own cognitive activitives. In short, the awareness of one's cognitive processes is the defining feature of this aspect of metacognition.

2.4.2 Process

The second component of Flavell's model of cognitive monitoring is metacognitive experiences referring to experiences pertaining to the monitoring process. Flavell (1981, 1984) contended that metacognitive experiences are feelings, ideas, thoughts and sensations concerning a cognitive enterprise. Such experiences may occur before, during or after a cognitive endeavor. Very often, metacognitive experiences have to do with one's progress in a cognitive event, i.e., what sort of progress one has made, is making, or is likely to make. In other words, metacognitive experiences typically are self-evaluations of the ongoing cognitive processing; they are experiences occurring during the monitoring process. When normal cognitive processing is smooth, metacognitive experiences may not become apparent. However, once a flicker of uncertainty or a clue of solution signals some difficulty or a breakthrough in the normal progression, metacognitive experience comes into play. Hence, metacognitive experiences may be described as "clicks and clinks" of actual or anticipated cognitive success and failure (T. H. Anderson, 1980, cited in Garner, 1987). Moreover, as Flavell (1984) has observed, metacognitive experiences are most "likely to occur in situations that would be expected to engender careful, conscious monitoring and regulation of one's own cognition" (p. 10). In this regard, metacognitive experiences are closely related to what Brown (Brown, 1978, 1981; Baker & Brown, 1984b) identified as "regulation of cognition".

For Brown, regulation of cognition is another major component of metacognition referring to self-regulatory activities (e.g., planning, monitoring, checking, testing, revising, etc.) used by a learner to orchestrate cognition. In contrast to metacognitive knowledge, these activities are not always stable and statable in that they are not necessarily used in every cognitive endeavor and the learner may not be able to state explicitly about these activities. Thus, the control function is the defining feature of this aspect of metacognition.

Comparing the notion of regulation of cognition to that of metacognitive experiences, it appears that Brown tended to emphasize the learner's deliberate attempt in controlling his/her own cognitive activities, whereas Flavell inclined to conceptualize metacognitive experiences in a broader sense including both cognitive reactions and affective feelings that one encounters before, during, or after a cognitive enterprise.[1] Nevertheless, both agreed that metacognitive experience, or regulation of cognition, typically occurs when cognitions fail. A related concern, then, is the deployment of cognitive and metacognitive strategies to remedy cognitive failure or assess cognitive progress.

2.4.3 Strategy

Another component of cognitive monitoring, according to Flavell (1981), is comprised of actions. These actions are strategies undertaken to further and assess cognitive progress. In this context, several defining characteristics of strategy should be mentioned. Garner (1987) submitted that strategies are sequences of deliberate, planful activities. When strategies become automatic, they become skills (Paris et al., 1983). Moreover, strategies must be applied flexibly and the learner must know when, where, and how to use them (Brown, Armbruster, & Baker, 1986). In other words, strategies are different from tactics in that the latter are blind techniques deployed to a given task without an understanding of how and why they work (Snowman, 1986). Flavell, on the other hand, suggested that one can distinguish cognitive strategies from metacognitive strategies. Cognitive strategies are used to make cognitive progress (e.g., verbal rehearsal to enhance remembering a list of items), whereas metacognitive strategies are invoked to monitor the cognitive progress (e.g., self-test to see if all the items are remembered). Examples of such cognitive and metacognitive strategies are verbal rehearsal, allocation of attention, note-taking, text summarization, text reinspection, skimming, self-questioning, self-testing, referring to an expert source, etc. (M. Lupart, 1984; Garner, 1987). It should be noted that a strategy can be cognitive in one case and metacognitive in another. For example, summarization is a cognitive strategy if it is used to synthesize information, and it is also a metacognitive strategy if it is used to monitor comprehension.

Similar to Flavell's contemplation, Brown (1978, 1981; Baker & Brown, 1984b) contended that keeping track of one's cognitive state is only a part of the cognitive monitoring process; one must know what to do when cognitive failures occur. Accordingly, her notion of regulation of cognition implies both process and strategy aspects. That is, besides the ongoing monitoring and checking process, the deployment of strategies is also an important component of the control dimension of metacognition.

---

[1] As pointed out by Paris and Winograd (1990), Flavell's description of metacognitive experiences entails motivational and emotional accompaniments. The motivational and emotional aspect of metacognition will be discussed in a later section.

Up to this point, it can be seen that Flavell's framework of cognitive monitoring is to a large extent parallel to Brown's conception of metacognition: cognitive monitoring consists of three main types of metacognitive skills -- knowledge (i.e., metacognitive knowledge), process (i.e., the regulating/monitoring process or metacognitive experiences), and strategy use (i.e., actions). How these three types of metacognitive skills are applied in the service of cognition, however, depends greatly on the learner's perceived goals and orientations to the task as well as his/her motivational beliefs about self and learning. In this context, the goal/motive and motivational aspect of cognitive monitoring comes into play.

2.4.4 Goal/motive and motivational factor

The final component of Flavell's model of cognitive monitoring is comprised of cognitive goals referring to implicit or explicit objectives that initiate and maintain the cognitive endeavor.

From the perspective of the teacher or researcher, the cognitive goals in a learning situation tend to be operationalized as criterial tasks imposed on the learner (M. Lupart, 1984). From the perspective of the learner, however, the goals set for oneself in a learning situation appear to be closely related to one's motives of learning and personal beliefs about learning. In this regard, it is noteworthy to point out that Paris, Lipson and Wixson (1983) have described strategies as having components of "both skill and will" (p. 304). Unless learners want to and believe that they can accomplish a particular goal, it is unlikely that they will spend the time and energy it takes to activate relevant knowledge, engage in monitoring the process and invoke strategies to achieve cognition (Garner, 1987). The learner's goals of learning, therefore, play an important role in the learning process.

In fact, Biggs (1985, 1987b) has developed a model of student learning primarily "in terms of the *motives* a student has for engaging a learning task, and the *strategies* adopted so that the student's intentions are realized" (p. 2). There are three major types of motive-strategy combination; each combination defines a distinct approach to learning. These three approaches are surface, deep, and achieving. Accordingly, the surface approach consists of the surface motive component and the surface strategy component. The surface motive is instrumental; it main intention is to meet requirements with minimal effort. The surface strategy is reproductive and is often associated with rote learning. Similarly, the deep approach comprises the deep motive component and the deep strategy component. The deep motive is intrinsic, striving to actualize one's interests, and the deep strategy is meaningful, extracting maximum meaning by reading widely and interrelating with previous relevant knowledge. The achieving approach also consists of the achieving motive and the achieving strategy components. The achieving motive is to publicly manifest one's excellence, and the achieving strategy is based on organizing one's time and working space. It should be noted that the motives and strategies can be mixed to produce a composite approach. For example, a student who takes a deep-achieving approach to learning is both intrinsically and achievement motivated, and employs strategies to read for meaning in an organized way. On the other hand, a student who adopts a surface-achieving approach is extrinsically and achievement motivated, and utilizes surface-achieving strategies such as rote learning in a highly organized manner. All these major or composite approaches, according to Biggs, involve varying degrees of metalearning (i.e., a subprocess of metacognition) and lead to qualitatively different learning outcomes. Whereas students who adopt the deep approach usually display the greatest metalearning capability, those who take the surface approach often show little or minimal metacognitive awareness, with students who employ the achieving approach in between. It can be seen, then, that the motivational state and strategy deployment combination represents a student's general orientation to learning.

Biggs' analysis of the motive-strategy congruence illustrates the close relationship between motivation and metacognition. Current perspectives on metacognition and cognitive monitoring also emphasize the motivational correlates of metacognition (e.g., Borkowski, Day, Saenz, Dietmeyer, Estrada, & Groteluschen, 1992; Miechenbaum & Biemiller, 1992; Paris & Winograd, 1990; Weinert, 1987). As Paris and Winograd (1990) argued, "A view of metacognition in the service of academic learning and the development of schoolcraft necessarily entails motivated, social interactions" (p. 24). Similarly, Borkowski et al. (1992) have suggested an extension of metacognitive theory to encompass personal and motivational components. They maintain that:

> The fundamental premise in the newest version of metacognition is that personal-motivational factors energize the self-regulating executive skills necessary for strategy selection, implementation, and monitoring. (p. 3)

In view of recent advances in metacognitive theory development, it is suggested that the goal component of Flavell's model of cognitive monitoring be modified to include motivational components.

2.4.5 Relations among the Components

In view of the above analysis, cognitive monitoring consists of at least four dimensions: knowledge, process (experience), strategy, and goals and motives, with related motivational variables such as self-concept, locus of control, and individual attribution style included in the final dimension. It should be noted that, while these components could be seen as logically distinct, they are closely interrelated. For example, a particular goal or motive can serve to activate relevant metacognitive knowledge which prompts the monitoring process that in turn triggers the use of cognitive and metacognitive strategies. In sum, cognitive monitoring can become an exceedingly complex process; each component can prompt each of the others (Flavell, 1981; Garner, 1987).

2.5 Comprehension monitoring: Cognitive monitoring in reading

Baker and Brown (1984a) have postulated a hierarchical relationship between metacognition, cognitive monitoring, and comprehension monitoring. Metacognition can be viewed as a superordinate term. Whereas cognitive monitoring is a fundamental form of metacognition concerning the knowledge and use of self-regulatory mechanisms in general, comprehension monitoring applies to oral or reading comprehension. For the purposes of the present research, the following analysis of comprehension monitoring will be focused on cognitive monitoring in comprehension of connected discourse.

Several researchers have attempted to define comprehension monitoring. For Baker and Brown (1984a), "comprehension monitoring entails keeping track of the success with which one's comprehension is proceeding, ensuring that the process continues smoothly, and taking remedial action if necessary" (22). Wagoner (1983), on the other hand, inclined to define comprehension monitoring from two aspects: first, knowing about comprehension and second, knowing how to comprehend. The first aspect, knowing about comprehension, is a conscious process involving the reader's recognition of failure to understand the text message. The second aspect, knowing how to comprehend, consists of fix-up strategies that the reader may utilize once the failure to understand has been detected. Subsequently, Baker (1985b) conceptualized the comprehension monitoring process into two phases: the evaluation phase and the regulation phase. Evaluation refers to the reader's keeping track of his/her current state of organizing comprehension, where regulation refers to the reader's actions to remediate comprehension failures. Synthesizing the views of these authors, it appears that phase comprehension monitoring is a process comprised of at least two dimensions: (1) evaluation of comprehension including recognition of comprehension failure; and (2) remediation of comprehension failure including use of various fix-up strategies. While such a definition specifies two major monitoring activities embedded in the process of reading comprehension, Flavell's model seems to provide a more comprehensive view of the complexity of cognitive monitoring and has greater relevance to our discussion of comprehension monitoring. The reason is two-fold. First, the two dimensions mentioned above correspond to the experience component and the action component of the Flavell model of cognitive monitoring respectively. In other words, the two dimensions of comprehension monitoring are already included in the Flavell model. Furthermore, it is argued that these two dimensions cannot be accurately examined without looking at their relationships to the reader's metacognitive knowledge, and his/her goals and motives when he/she is engaged in the reading process. In this regard, the other two components of the Flavell model come into play. The following analysis of comprehension monitoring, therefore, will adhere rather closely to Flavell's (1981) framework of cognitive monitoring as previously discussed, with motivational variables included as subcomponents of the goal and motive component.

2.5.1 Knowledge

In the context of reading comprehension monitoring, metacognitive knowledge refers to the reader's knowledge about himself/herself as a reader, the text he/she encounters, the reading task he/she faces and the strategies he/she employs while reading. Accordingly, knowledge of comprehension monitoring can be divided into four categories: learner characteristics, text, task, and strategy (Baker & Brown, 1984b).

Knowledge of learner characteristics or, in Flavell's taxonomy, person variables, is concerned with the strengths and weaknesses the reader knows about himself/herself as a reader. The reader, for instance, may know that he/she is good at grasping the main ideas of a passage but not good at vocabulary. He/she may also know that he/she needs to use context cues to compensate for his/her weak vocabulary. Knowledge of personal strengths and weaknesses as a reader, therefore, affects one's comprehension monitoring activities.

Knowledge of task variables refers to the reader's knowledge about the nature of information in a passage. For example, the reader may judge a passage as simple, complex, easy or difficult to comprehend. Also, such awareness includes the reader's understanding of task demands. He/she may view reading as a word-decoding or a meaning-getting process. Moreover, he/she may realize that different kinds of reading tasks require different criteria and he/she may need to vary his/her reading strategies to achieve different purposes. In short, knowledge of task variables affects one's efficiency in adjusting one's effort in response to task demands and thereby affects one's monitoring functions in reading.

Knowledge of text variables consists of the knowledge the reader has about salient aspects of the material he/she reads. As pointed out by Baker and Brown (1984b), vocabulary, syntax, the clarity of presentation, the structure, and the topic of a passage are all variables contributing to text difficulty. The reader, for example, needs to identify important elements of the passage he/she is reading in order to monitor comprehension.

Similarly, the reader's sensitivity to text structure also prompts different monitoring activities. Awareness of various text variables, thus influences the reader's comprehension monitoring mechanisms.

The final component, knowledge of strategy variables, refers to the reader's knowledge about the nature and usefulness of certain cognitive or metacognitive actions which can be utilized to achieve or ensure comprehension. The reader's awareness of, for instance, "fix-up" strategies (e.g., rereading) for comprehension failures is particularly related to his/her monitoring progress in reading.

Just like the knowledge variables in cognitive monitoring, the above mentioned categories of knowledge concerning comprehension monitoring are interrelated. For example, the reader's awareness of his/her own characteristics is at least in part dependent upon his/her sensitivity to the utility of various reading strategies. On the other hand, the reader's awareness of his/her own characteristics is affected by his/her knowledge of task demands and text structures. On the whole, the reader's knowledge of person, text, task, and strategy variables are highly interactive and are always interwoven in nature.

2.5.2 Process

The experience component of cognitive monitoring has been analyzed in the previous section. Relating previous discussion to the present context, the experience component of comprehension monitoring could be viewed from two perspectives. If Flavell's broader conception is applied, experiences of comprehension monitoring are concerned with the reader's feelings, sensations, ideas and thoughts which pertain to but may occur before, during or after his/her reading endeavor. Other researchers (e.g. Baker, 1979; Baker and Brown, 1984a; Garner, 1987), however, tended to confine their discussions of this aspect of comprehension monitoring to the monitoring process itself. For the purposes of the present research, the latter notion will be adopted. That is, the experience component of comprehension monitoring refers to the monitoring process itself, signifying the reader's ongoing evaluation of his/her progress in comprehension (see chapter 5 definition section).

If experiences of comprehension monitoring are mainly concerned with the reader's evaluation of the current state of his/her ongoing comprehension, Baker's (1985a,1985b) analysis of standards of evaluation has provided us with a deeper understanding of this phase of comprehension monitoring. According to Baker, there are three basic types of standards that the reader uses to evaluate his/her understanding: lexical, syntactic, and semantic. Whereas the lexical standard requires sensitivity to individual words, the syntactic standard requires awareness to the grammatical constraints of individual sentences. In contrast, the semantic standard demands consideration of the meaning of individual sentences and the text as a whole. This final type of standard, argued Baker, is most crucial to effective comprehension. Furthermore, the reader may use one or multiple standards of evaluation during a single encounter with a text. The evaluation phase, or the experience component of comprehension monitoring, thus, is a manifold rather than a unitary phenomenon.

2.5.3 Strategy

Since experiences of comprehension monitoring, like experiences of cognitive monitoring, most often occur when the reader encounters difficulties, they always lead to the reader's decisions about further actions. The strategy component, or the regulation phase as Baker (1985b) labeled it, of comprehension monitoring thus comes into play.

Strategies, as previously discussed, refer to deliberate and planful activities undertaken to assess one's cognitive progress or remediate cognitive failures. In the context of comprehension monitoring, strategies, accordingly, are deliberate and planful actions used to assess one's level of comprehension or resolve comprehension difficulties. To assess degree of comprehension, the reader may engage in self-questioning or self-testing. To resolve comprehension failures, the reader may store puzzlement in memory as a pending question hoping that the author will later provide clarification. Possibly, the reader may decide to look back or look ahead in the text, or seek help from outside sources such as looking upon a dictionary or consulting an expert of the area (Baker & Brown, 1984a, p. 41). The variety of strategies depicts the complexity of the strategy component of comprehension monitoring.

2.5.4 Goal/motive and motivational factor

The final component of comprehension monitoring is comprised of the reader's goals for reading and his/her motivational state. As pointed out by Baker and Brown (1984a, b), how the reader monitors his/her comprehension depends, to a large extent, on his/her perceived goal(s) for reading. If the reader regards reading as a decoding process, he/she would probably process in a word by word manner and hence would hardly monitor his/her comprehension beyond the word level. On the contrary, if the reader views the goal of reading to understand the content, he/she would attend to the meaning of what he/she reads and monitor his/her own status in this aspect. Furthermore, different kinds of reading tasks imply different criteria. Reading for leisure, for instance, is different from reading for study. Consequently, skimming may be appropriate for the former but not for the latter purpose of reading. In a word, the reader has to adjust his/her monitoring activities in response to the goal of a reading task, be it set by himself/herself or by others (e.g., teachers). In this context, it can be seen that the reader's goal is closely related to his/her metacognitive knowledge of task variables: his/her conception of reading and awareness of various demands. This instance once again illustrates the interrelations among the components of comprehension monitoring.

More importantly, whether the reader will accomplish a particular goal of a reading task is related to his/her motives and interests. If the reader is not willing to achieve the particular goal, he/she is unlikely to bother to monitor his/her comprehension. Motives and related motivational factors, as illustrated in the section of cognitive monitoring, therefore, play a vital role in the reading process (e.g., Borkowski, Weyhing, & Carr, 1988; Garner, Alexander, & Hare, 1991; Palincsar, Brown, & Martin, 1987; Sivan, & Roehler, 1986; Wagner, Spratt, Gal, & Paris, 1989). In this regard, Wagner et al. (1989) have correctly pointed out the need for integrating cognitive, metacognitive, and motivational accounts of reading skill acquistion and performance:

> ... it is increasingly clear that children's beliefs, metacognition, and reading become interconnected as children progress through school and acquire literacy .... Although reading is considerably more than believing or knowing or trying hard, our understanding of acquisition of literacy is substantially enchanced when we measure the concurrent development of those important dimensions of literacy acquisition. (p. 292)

What types of motivational variables, then, are of most importance ? In his discussion of metacognition and motivation as determinants of effective learning and understanding, Weinert (1987) pointed out:

> An attempt to integrate motivation and metacognition means one must relate theoretical concepts concerned with knowledge about the self, performance expectations and monitoring of one's own actions as perceived in the metacognitive literature with concepts such as self-perception of ability, expectation of success and fear of failure, causal attributions for success and failure, and processes of self-evaluation, from the motivation research domain. (p. 11)

Among the motivational variables suggested by Weinert, the learner's attributional beliefs (i.e., perceived causes of failure and success) have received much attention from many researchers. For example, Borkowski and his associates (e.g., Borkowski, Carr, Rellinger, & Pressley, 1990) have prosposed that attributional beliefs are of particular importance for metacognitive development and strategy deployment. They contended that effort-related attributions are likely to motivate children to acquire and use new strategies and metacognitive knowledge in general, and thereby contribute to the emergence of a mature metacognitive system. Other researchers (e.g., Relich, Debus, & Walker, 1986; Short, & Weissberg-Benchell, 1989) also suggested that attributional beliefs about the role of effort support both metacogntive functions and academic performance. In light of the recent advances in metacognitive theory and research, attributional beliefs were the main motivational component included in the model of comprehension monitoring developed for the present research.

2.5.5 Relation to Reading Proficiency

Many reading theorists and cognitive psychologists regard comprehension monitoring as a crucial component of competent reading and successful learning. Mangano, Palmer, and Goetz (1982), for example, maintained that the ability to monitor one's comprehension is necessary for academic excellence. They commented:

> The reader must be flexible and adaptive, modifying the reading process to fit his or her purpose for reading and the characteristic of the text being read. Comprehension monitoring, the assessment of one's own understanding, is a crucial process ... The metacognitive analysis of reading suggests that failure to effectively monitor comprehension or to apply appropriate or correct strategies is potentially a source of serious comprehension difficulties. (p. 366)

Markman (1981) held a similar position in stating that:

> In order to study effectively, one must be able to differentiate what is understood from what still requires clarification. One must be sensitive to the level of one's comprehension to know what to re-read, when to ask questions, what additional information is needed, etc. Without such knowledge about comprehension, comprehension itself will suffer. (p. 81)

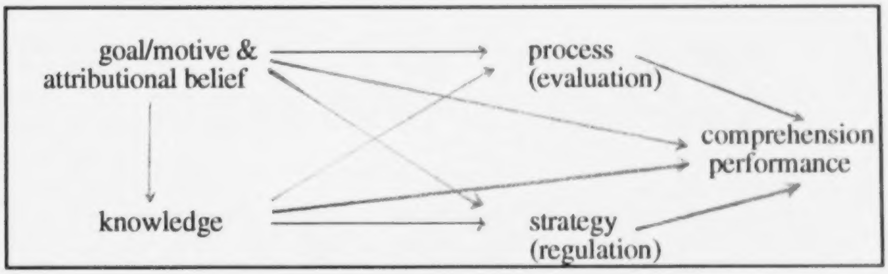
While recognizing that skilled readers need not devote constant attention to evaluating their understanding because of their rapid and automatic processing skills, Baker and Brown (1984b) believed that mature readers typically engage in comprehension monitoring when some obstacle to comprehension arises. The authors subsequently brought forward Whimbey's (1975) characterization of a good reader that, according to them, captures the essence of comprehension monitoring:

> A good reader proceeds smoothly and quickly as long as his understanding of the material is complete. But as soon as he senses that he has missed an idea, that the track has been lost, he brings smooth progress to a grinding halt. Advancing more slowly, he seeks clarification in the subsequent material, examining it for the light it can throw on the earlier trouble spot. If still dissatisfied with his grasp, he returns to the point where the difficult began and rereads the section more carefully. He probes and analyzes phases and

> sentences for their exact meaning; he tries to visualize abstruse descriptions; and through a series of approximations, deductions, and corrections he translates scientific and technical terms into concrete examples (Whimbey, 1975, p. 99; quoted in Baker & Brown, 1984b, p. 357).

Taken together, it is generally agreed that effective readers must have some awareness and control of their cognitive activities while engaged in reading. Comprehension monitoring, consequently, is viewed as one factor critical to growth in reading comprehension proficiency. With respect to the relations among the monitoring components, it is hypothesized that the process and strategy components are affected by the goal/motive and the knowledge components (e.g, a particular goal or motive or relevant metacognitive knowledge prompt the monitoring process that in turn triggers the use of cognitive and metacognitive strategies), whereas the process and strategy components have direct influences on comprehension performance. Figure 2-2 depicts the model of comprehension monitoring adapted in the present research.

Figure 2-2
The model of comprehension monitoring conceptualized in the present research



2.6 Chapter Summary

Current reading theories characterize reading as an interactive, constructive process in which the reader is an active information processor striving to synthesize information from various levels of sources to construct a sensible and coherent representation of the meaning of the text. This position implies that how the reader directs his/her cognitive resources is crucial to effective comprehension. Accordingly, metacognition, referring to knowledge and control of cognition, is deemed to play a vital role in reading. Whereas cognitive monitoring is a fundamental form of metacognition concerning the knowledge and use of self-regulatory mechanisms in general, comprehension monitoring is seen as cognitive monitoring in reading. Adapted from the model proposed by Flavell (1981), comprehension monitoring consists of at least four dimensions: knowledge, process, strategy, and goal/motive as well as related motivational variables. In other words, the ability to monitor one's state of understanding depends on one's metacognitive knowledge, metacognitive experience (i.e., evaluation), use of strategies (i.e., regulation), and motivated intention to complete the task. All of these influence the degree to which the reader will be able to engage in active monitoring which, presumably, in turn will lead to successful reading and learning outcomes. In short, the theoretical position that comprehension monitoring is an important determinant of reading proficiency appears to be supported by many reading theorists and cognitive psychologists. That is, it is theoretically sound to hypothesize important links between comprehension monitoring and reading competence. However, if comprehension monitoring is a multidimensional construct as described earlier, which, if not all, aspects of comprehension monitoring are most related to reading achievement? Now, we need to turn from theory to research to examine the empirical relationships between comprehension monitoring and reading ability.

3. EMPIRICAL RESEARCH

Numerous studies on metacognitive aspects of reading have been carried out in recent years. In this chapter, a sampling of the recent research literature is presented. Following the theoretical framework established in the previous chapter, reading research on metacognitive knowledge is first reviewed, next the monitoring process and strategy use, and finally goal/motive and motivational aspects related to comprehension monitoring. Studies in these four areas are discussed along the dimensions of age and reading achievement.

In order to provide a boundary for this chapter, several distinctions are made. First, in discussing differences in reading competency among learners, the terms "skilled" or "good" readers, and "less-skilled" or "poor" readers are employed, intending to reveal "a contrast between two points located on a continuum of reading proficiency" (Garner, 1987, p. 31). Second, a distinction is drawn between reading comprehension and listening comprehension. This review focuses on investigations designed to examine reading comprehension monitoring, although some classic listening comprehension monitoring studies are also discussed. A third distinction is made between reading for meaning and reading for remembering (Baker & Brown, 1984b). Whereas the former denotes comprehension, the latter refers to studying. The focus of this review is on immediate comprehension of connected discourse rather than on studying of text for later recall. Thus, studies designed to investigate studying are not included. This distinction, however, does not rule out recall as a concomitant product of the process of comprehension thereby used as a dependent measure in the studies reviewed (Wagoner, 1983).

3.1 Research on the knowledge aspect of comprehension monitoring

A number of studies have utilized an interview format to assess learners' metacognitive knowledge about reading. While these studies have attempted to obtain learners' introspective knowledge about various aspects of reading, discussions here are focused on research findings pertaining to comprehension monitoring.

Following the prototypic study conducted by Kreutzer, Leonard, and Flavell (1975) in the area of metamemory, Myers and Paris (1978) investigated second and sixth graders' awareness of certain person, task, and strategy variables relating to reading. They found that students of both grades were aware of the effects of personal variables such as background knowledge and personal interest on reading. Younger readers, however, were less sensitive to task dimensions and reported fewer strategies for monitoring their own understanding and for resolving comprehension failures.

Using a structured reading task as well as an interview schedule, Canney and Winograd (1979) investigated conceptions of reading held by students in grades two through eight. Subjects were presented with intact or disrupted passages and asked if each type of passage could be read and why. Also, they were given a questionnaire probing their conceptions of reading. The researchers found that older and better readers gave more "meaning-getting" responses to metacognitive questions about reading, while the younger and poorer readers tended to focus on the decoding aspect of reading.

Similar findings were reported by Gambrell and Heathington (1981) in their comparison study with adult disabled readers and proficient college readers. Utilizing a metacognitive interview format similar to that of Myers and Paris (1978), the researchers assessed adult readers' awareness of task and strategy variables that affect reading. Disabled adult readers were found to be decoding-oriented, less sensitive to text structures and strategy variations, and less aware of their role in facilitating comprehension.

Moore and Kirby (1981) replicated the Myers and Paris (1978) study with an intention to also investigate within-grade ability differences. As a replication, Moore and Kirby reported similar findings, namely, that younger readers were less aware than their older counterparts of readers' goals, task demands and strategy variations. With respect to within-grade differences, the sixth-grade high-ability group was more aware of the search for informative words during skimming.

In another study, Moore (1983), making use of two interview schedules, examined the development of metacognitive knowledge about reading across three age groups (i.e., 6-, 8-, and 10-year-olds) and two reading levels (i.e., high- and low-ability levels). It was found that high-ability and older readers were more cognizant than low-ability and younger readers of many important parameters of reading such as the nature of good readers and various task demands and strategy variables. The results also indicated that the interview format of asking direct questions was a more appropriate strategy for eliciting information than the technique which involves presenting hypothetical dialogues between children before asking questions.

Kirby and Moore (1987) conducted another interview study on metacognitive awareness about reading with children in grades two, four, and six. This study was different from their previous investigations in that interval scoring scales were developed for each interview item to enable the construction of broader composite indices of metacognitive awareness. A factor analysis of the interview item scores yielded four factors: withholding closure (i.e., the recognition that some types of skills are not necessarily related, for example, math and reading), reading skill (i.e., specific knowledge of reading skills, for example, characteristics of a competent reader), semantic selection (i.e., the recognition that reading is meaning-oriented, for example, strategies enhancing meaningfulness of reading), and use of context (i.e., use of contextual clues to resolve comprehension difficulties, for example, contextual clues for the meaning of an unknown word). Further analyses using the factor scores revealed that metacognitive awareness in the four areas increased with grade, and that grade-six skilled readers displayed a particularly high level of awareness in the two semantic factors (i.e., semantic selection and use of context).

There is some evidence that good and poor readers not only differ in their metacognitive awareness about reading but also exhibit different motivational/affective orientations towards reading. Raykovicz, Bromley, and Mahlois (1985) investigated fifth graders' beliefs about the task of reading. While both the good and poor readers indicated that background knowledge would affect reading and that reading for general meaning was easier than for details, overall differences were found between the groups. Good readers' responses revealed that they were self-motivated, typically found reading enjoyable, preferred silent rather than oral reading, and used intuition and mental imaging to aid comprehension. In contrast, poor readers tended to perceive reading as a task required at school and seldom considered it enjoyable. Half of the poor readers preferred reading aloud or stated no preference. Moreover, few poor readers indicated any tendency to figure out independently the meaning of sentences or paragraphs.

While the results of the above studies have in general revealed a relationship between metacognitive knowledge and reader maturity or proficiency, there are problems with interview studies which rely on verbal reports as data without other confirming evidence (see, e.g., Cavanaugh & Perlmutter, 1982; Garner, 1982, 1988; and discussion of methodological considerations in the following chapter). One major problem is that we do not know whether the readers who differ in verbalized knowledge of reading actually differ in use of this knowledge as well. In other words, although young and poor readers seem to be less aware of the existence and values of techniques for monitoring comprehension, it is not clear whether or not they are also less efficient in monitoring their comprehension in actual situations. The study by Garner and Kraus (1981-1982) was one example.

Garner and Kraus (1981-1982) interviewed seventh graders about their knowledge of comprehension difficulty and reading strategies. Two weeks later, they investigated the students' comprehension monitoring behavior utilizing an error detection task. Subjects were required to read two narrative passages containing informational inconsistencies and decide whether the passages needed to be changed. Reader group differences emerged in both interview responses and in error detection. In the interview, good readers provided meaning-oriented responses, while poor readers' comments focused on decoding and oral fluency. Also, in the error detection task, poor readers failed to detect inconsistencies. The results suggested that poor readers may use decoding as a criterion for evaluating comprehension and therefore fail to monitor their comprehension beyond the word by word level. In short, as revealed in this study, poor readers seem to have less knowledge of comprehension monitoring and are less successful in evaluating and regulating their comprehension than good readers.

Assuming that knowledge of reading situations and reading strategies is necessary for successful strategy use, Forrest-Pressley and Waller (1984) developed an extensive series of tasks for poor, average, and good readers in third and sixth grades in an attempt to examine their metacognitive knowledge, monitoring process and strategy deployment. The interview part of the study showed that knowledge of decoding, comprehension, and advanced strategies increased with age and reading ability. In particular, young/poor readers gave little indication that they knew how to monitor comprehension. Many young/poor readers, for instance, said that they would be ready for a test after reading a story once and that they had no idea how well they had done before getting the test back. In addition, they did not know how to adjust themselves to different reading situations. Most young/poor readers said that they read the same way for fun as they read for studying. To further investigate the relationship between knowledge and monitoring, in another part of the study the subjects were asked to identify and explain errors in words and sentences. It was found that in most cases correlations between knowledge and monitoring of words, and between knowledge and monitoring of sentences were significant. Summing up their findings, the authors suggested that young/poor readers are deficient in metacognitive knowledge and are less apt to monitor comprehension. In other words, the research findings indicated a relation between monitoring knowledge and monitoring performance in reading.

The research findings reviewed to this point appear to be quite consistent; individuals differ considerably in their metacognitive awareness as a function of their age and reading ability. Characteristically, young and poor readers perceive reading more from a decoding perspective rather than an extraction of overall meaning. Accordingly, they are less aware of the existence and value of techniques for monitoring comprehension. Moreover, they have meager strategic repertories for different reading situations. Notwithstanding methodological limitations of interviews which will be discussed in chapter 4, all these findings suggest that young and poor readers have misconceptions and limited metacognitive awareness about various aspects of reading. While a few studies have investigated both knowledge and process aspects of comprehension monitoring, more have focused on the process and strategy dimensions of comprehension monitoring. It is the research on readers' monitoring processes and strategies that is reviewed next.

3.2 Research on process and strategy aspects of comprehension monitoring

Information about readers' ongoing comprehension monitoring processes and use of strategies to resolve comprehension failures has been obtained through a variety of research techniques. While some studies have focused exclusively on the process aspect of comprehension monitoring, more recent studies have attempted to reveal both the process (i.e., evaluation) and the strategy (i.e., regulation) phases of comprehension monitoring.

3.2.1 Data from error detection studies

One frequently used tactic in investigating comprehension monitoring has been the error detection paradigm which involves embedding problems or errors into an oral or written discourse and assessing the subjects' ability to detect them. The rationale for this procedure is that subjects should notice the problems or errors if they are keeping track of their understanding. Markman's (1977, 1979, Markman & Gorin, 1981) work with oral error detection is classic of this type of research and is discussed first.

In a series of studies examining children's ability to analyze oral messages for completeness and consistency, Markman (1977) asked children in grades one through three to serve as consultants to evaluate incomplete instructions for a card game and magic trick. After each child had listened to one set of instructions, a series of probe questions was asked until the child indicated that he/she had noticed the inadequacy of the instructions. Similar procedures applied to anther set of instructions. As the results indicated, it took an average of nine, six, and three probes for first, second, and third graders, respectively, to note the missing information. Markman hypothesized that the poor performance of younger children may be due to a lack of constructive processing.

In her second series of investigations, Markman (1979) turned her attention from detection of informal incompleteness to textual inconsistencies. Entitled as consultants, children from grades three, five, and six were asked to listen to essays that contained explicit or implicit inconsistencies and help the experimenter find problems in the essays. A series of probe questions was given to the children individually after they had listened to an essay. While the results showed that, as expected, implicit inconsistencies were more difficult for children to detect, what was surprising was the low detection rates of explicit inconsistencies across all grades; nearly half of the children missed all or all but one of the inconsistencies even in the explicit condition. Due to the poor performance, Markman conducted another experiment with the third and sixth graders in which half of the subjects were explicitly informed about the existence of problems. Cueing did not significantly increase the performance of the third graders, but there was a significant increase in detecting the inconsistencies for the subjects in grade six.

Markman and Gorin (1981) continued to investigate the effects of evaluation criteria on children's ability to detect inconsistencies. Children of eight and ten years listened to a series of short essays containing either falsehoods or inconsistencies. Overall detection of problems was greater for the 10-year-olds when they were instructed to find specific kinds of problems. Moreover, the type of instruction given affected the type of problem detected. That is, children detected more falsehoods when set to find falsehoods and more inconsistencies when set to find inconsistencies, indicating that comprehension monitoring is more effective when criteria for evaluation are made explicit.

Another representative study of listening comprehension monitoring is the one conducted by Flavell, Speer, Green, and August (1981). Kindergarten and second-grade students were told to make a building with blocks following a set of taped instructions containing ambiguities, unfamiliar words, insufficient information or unattainable goals. They were encouraged to stop the tape and replay the instructions whenever they wished. Nonverbal problem detection behavior during listening and later verbalization of the problems were recorded. The results showed that second graders significantly demonstrated more evidence of problem detection, both verbally and nonverbally. For kindergarteners, although they also exhibited some nonverbal problem detection behavior, they were unable to verbalize the problem. On the whole, the results were consistent with those of Markman, reflecting that there is a developmental difference in children's ability to monitor listening comprehension; older children are more able to identify listening comprehension difficulties. However, what was unique for the Flavell et al. study was that even kindergarteners generate signals of comprehension monitoring though they cannot verbalize their puzzlement and may not be able to recognize the importance of problem awareness. These findings attest to the importance of using multiple measures in comprehension monitoring research.

Turning from listening comprehension monitoring studies to reading comprehension monitoring research utilizing the error detection paradigm, we now look at the representative studies carried out by Garner and her associates (Garner, 1980, 1981; Garner & Anderson, 1981-1982: Garner & Kraus, 1981-1982; Garner & Taylor, 1982), Baker and her colleagues (Baker, 1979, 1984a, 1984b, 1985a; Baker & Anderson, 1982; Baker & Zimlin, 1989), Winograd and Johnston (1982), and Zabrucky and her colleagues

(Zabrucky, 1990; Zabrucky & Moore, 1989; 1991; Zabrucky, Moore, & Ratner, 1985; Zabrucky, Moore, & Schultz, 1987; Zabrucky & Ratner, 1986), among others.

Garner and her colleagues have worked extensively on comprehension monitoring in upper elementary and junior high school students. In her initial study, Garner (1980) asked readers in grades seven and eight to serve as editors to examine two expository passages, one containing intrasentential information inconsistencies in certain segments. The subjects were then asked to rate segments of the passages for comprehensibility. Good readers varied their rating of consistent and inconsistent material, but poor readers made little differentiation. Garner speculated that unwillingness to admit comprehension failures to an adult and/or use of intrasentence acceptability as an evaluation standard might be the reasons accounting for the rating pattern.

In a follow-up study, Garner (1981) presented poor readers in grades five and six with three short passages: one informationally consistent, one informationally inconsistent and one containing non-meaning-changing polysyllabic modifying words (i.e., simple words replaced by polysyllabic words with similar meanings). The passage containing polysyllabic words was identified by the subjects as significantly more difficult to understand, while consistent and inconsistent texts were related as equally comprehensible. The results led Garner to argue that the hypothesis of "piecemeal processing" among poor readers was supported. That is, poor readers "attend a great deal on decoding of individual words and do not note major informational assaults on comprehensibility of ideas" (p. 162). These findings seem to be in keeping with poor readers' word-decoding conception of reading as disclosed in the metacognitive knowledge research discussed earlier.

To further investigate the effects of different types of inconsistency on comprehension monitoring, Garner and Kraus (1981-1982) asked good and poor comprehenders in grade seven to read passages containing either intrasentential inconsistencies or intersentential inconsistencies and decide if the passages needed to be changed. Poor comprehenders failed to identify any inconsistencies. Good comprehenders, though not performing at ceiling level, were somewhat successful at identifying intersentential inconsistencies and very successful at detecting intrasentential inconsistencies.

Assuming that schema activation would improve poor readers' comprehension monitoring abilities, Winograd and Johnston (1982) gave skilled and less-skilled sixth-grade readers passages containing anomalous sentences and the editing task under a preparation or a no-preparation (i.e., no schema activation) condition. The preparation was a task in which the subjects looked at a picture directly related to the subsequent reading passage and were asked to discuss the picture. In the no-preparation condition the subjects were asked to read a word list consisting of the words that would appear in the subsequently reading passage. The results did not support the proposed hypothesis; schema preparation before reading had no significant effect on error detection. Furthermore, while skilled readers performed significantly better than less skilled readers, a surprising number of subjects failed to mention some very blatant errors. Only 56% of the good readers and 18% of the poor readers reported all four of the target anomalies. Speculating that the error detection paradigm did not provide a sensitive measure of comprehension monitoring, the researchers noted several limitations of the paradigm including existence of confounding variables, lack of explicit evaluation standards, variety of target errors, overreliance on self-reports, and inadequate use of probing (these criticisms will be a readdressed in chapter 4). Winograd and Johnston's comments, again, point to the importance of the use of multiple measures in investigating comprehension monitoring.

In response to Winograd and Johnston's (1982) criticisms of the error detection paradigm, Garner and Anderson (1981-1982) modified the Garner (1981) study by giving either one of three levels of directions (no indication, implicit indication, and explicit indication of problems) before presenting the error detection task to each of three groups of intermediate-grade students. It was expected that explicit indication of problems would increase subjects' error detection rates. Unexpectedly, no significant differences were observed. Moreover, students with implicit instructions outperformed students with similar instructions in the previous study by nearly 50 per cent. The investigators, nevertheless, argued for the validity of the adapted research paradigm since free recall was added to allow analysis for memory failures and the number of probings was limited to reduce the tendency of overuse. They hypothesized that the present pattern of results was due to the effects of experimental material and suggested that materials be a major concern for further research in the area of comprehension monitoring.

In another study, Garner and Taylor (1982) examined the effects of attentional assistance on error detection. Children in grades two, four, and six were presented with passages containing intrasentential inconsistencies. Again, as in the previous studies, subjects were asked to be editorial consultants and decide if the passages needed to be changed. Attentional assistance through probing was offered to aid subjects in noting inconsistencies. The results showed that only good readers appeared to benefit from attentional assistance. Furthermore, while older and better readers outperformed the younger and poorer readers in error detection, reflecting developmental and ability differences consistent with most previous studies, few readers exhibited spontaneous monitoring of comprehension.

The low error detection rates were not only apparent in studies of elementary and junior high students (e.g., Garner, 1980, 1981; Garner & Taylor, 1982; Markman, 1979; Winograd & Johnston, 1982) but also evident in studies with adult readers. For example, Baker (1979) asked college readers to read expository passages containing either inconsistent information, unclear references, or inappropriate connectives. They were required to complete a probed recall after reading, and were then informed about the existence of confusions and were asked to report any detection. The spontaneous error detection rate was 23%. After informing the subjects about the existence of problems, the detection rate only increased to 38 %. Analysis of recall protocols and retrospective responses, however, indicated that many failures to detect problems were due to automatic and unconscious use of fix-up strategies and different criteria for adequacy of comprehension. These findings suggested that solely relying on retrospective reports of error detection (an off-line measure) may not accurately reflect one's comprehension monitoring; employing other on-line measures may prove helpful.

To obtain more conclusive evidence of comprehension monitoring in mature readers, Baker and Anderson (1982) used an on-line direct measure. The investigators presented college students at a computer terminal, with expository passages, some of which contained informational inconsistencies. Prior to reading, half of the subjects were told about possibilities of inconsistencies in some passages while the other half were not informed. Passages were then presented sentence by sentence and rereading of a previous sentence or restarting of a segment was allowed. The number of rereading and exposure times of inconsistency-containing target sentences were recorded. It was found that students in this study, though far from perfect, were considerably more successfully at detecting inconsistencies than those in the previous one. This suggests the possibility that an on-line measure is a more reliable measure. Another interesting finding was that instructing subjects to be alert for inconsistencies did not affect reading behavior or inconsistency detection. The results were interpreted as indicating that mature readers in general are able to monitor their comprehension during reading with or without specific instructions.

In another study with mature readers, Baker (1985a) further examined the effects of instructions and evaluation standards on comprehension monitoring. College students differing in verbal ability were presented with expository passages, some of which contained lexical, external or internal inconsistencies. Half of the subjects were explicitly instructed that three different types of problems would be present in the passages and were given examples, while the remaining subjects were simply informed that the passages would contain problems but were not given specific instructions. They then read the passages, underlined anything problematic, evaluated the comprehensibility of each passage and explained why they had done so. All of the students who received general instructions rarely identified external and internal inconsistencies, suggesting that the external and internal consistency standards are not evaluation criteria students typically adopt. Moreover, students with higher verbal ability used more varied standards and used them more frequently than those with lower verbal ability, indicating that even among more mature readers, those who are less proficient show some over-reliance on the lexical standard for evaluating comprehension.

Also working with adults, Zabrucky, Moore, and Schultz (1987) examined the ability of young (mean age 22 years) and old (mean age 71 years) adults of varying educational levels to monitor comprehension of passages, some of which contained inconsistencies. Detection of errors was measured by both performance (i.e., underlining inconsistent sentences) and verbal (i.e., rating comprehensibility) measures. The results indicated that young and old adults were equally able to detect textual inconsistencies. However, the better educated adults identified more inconsistencies than the less educated adults. The results were interpreted as indicating that adults who continue their college education may be more skilled at monitoring their comprehension than adults who do not, even though overall adult age differences in comprehension monitoring ability do not appear to exist.

In a subsequent study, Zabrucky and Moore (1991) attempted to extend the previous finding by examining the effects of adults' education on using different standards to monitor comprehension. The subjects were asked to read expository passages, some of which contained nonsense words, external inconsistencies, or internal inconsistencies, and underline anything in the passages they thought was a problem. The researchers reported that skilled readers were more able to detect external and internal inconsistencies during reading, whereas less skilled readers were more likely to detect nonsense words and external consistencies. Similar to the results of their previous investigation, the researchers found that adults' educational level, but not age, was positively related to their error detection performance.

Zabrucky (1990) also investigated the effect of reading proficiency on young adult readers' ability to detect inconsistent sentences varying in referential cohesiveness. First year college students served as subjects in this study. Again, detection of errors was measured by both performance (i.e., recording inconsistent sentences) and verbal (i.e., rating comprehensibility) measures. She found that, overall, participants were more likely to detect inconsistent sentences that were referentially cohesive, and proficient readers were more likely than less proficient readers to detect inconsistencies. However, even good readers performed far from ceiling level. Zabrucky concluded that young adult readers with a beginning level of college education frequently fail to adequately evaluate their comprehension, and that instruction in monitoring skills for college students would be beneficial.

In addition to her work with adults, Baker (1984a) also examined the use of multiple standards for evaluating comprehension in children. She asked children of five, seven, nine, and eleven years to listen to or read narrative passages which contained two of the three types of problems: lexical, internal, or external inconsistency. The subjects were instructed to look for mistakes in the passages. Additionally, they were given immediate feedback after each trial and a second chance to find any missed problems. The results showed that although older children were more successful at identifying all three types of problems, overall performance of all age groups was much higher than has typically been reported in the literature. Baker argued that the higher performance was due to the provision of specific instruction and immediate feedback, indicating that children can be induced to monitor their comprehension more effectively with minimal intervention.

In a subsequent study, Baker (1984b) further studied use of multiple evaluation standards among children in grades four and six. Experimental procedures, except that elementary reading materials were used, were similar to those of the 1985a study with mature readers reported earlier. As expected, older and better readers displayed more varied and more frequent standard use than younger and poorer readers. Moreover, children who received specific instructions identified more problems and used more varied standards, demonstrating that children's comprehension monitoring activities are strongly influenced by the amount of guidance received. Of particular interest were the results regarding the patterns of standard use. The lexical standard was the dominant standard used, especially among younger and poorer readers. These results again reflect that, consistent with previous findings, younger and poorer readers tend to focus their attention more on the narrow dimension of individual word understanding than on the meaning-oriented aspects of comprehension. Finally, this series of studies conducted by Baker illustrates the need to consider skills of comprehension monitoring with respect to specific standards of evaluation and the importance of examining multiple standard use within a single setting.

Zabrucky and Moore (1989) conducted a study similar to that of Baker (1984b), but with three grade levels (i.e., grades four , five, and six) and three reading ability groups (i.e., good, average, poor). Different developmental and reading ability patterns were observed for the three standards investigated. The ability to use the lexical standard appeared to develop early and improve across the three ability groups. With respect to the use the external consistency standard, a steady progression in the development of ability was indicated. The ability to use the internal consistency standard, on the other hand, appeared to require heavier demands on reading ability and to develop late. The researchers also found that good readers were the only group able to detect more internal inconsistency problems after receiving specific instructions. They concluded that improving the evaluation skills of poor and average readers requires more than simply alerting them to different standards.

On the other hand, Baker and Zimlin (1989) demonstrated that students could benefit from specific instructions of standard use, if modeling, practice, and corrective feedback were offered along with examples of different standards. The researchers randomly assigned fourth-grade students, identified as average and above-average readers, to one of the three treatment groups. One group received specific instructions in using three lower-level "microstructure" standards. Another group was provided with specific instructions in the use of three higher-level "macrostructure" standards. The third group received no instruction and served as a control group. The lexical (e.g., unknown words), external consistency (e.g., untrue information), and propositional cohesiveness (e.g., ambiguous referents) standards were the three standards classified as microstructure standards; the researchers argued that they involve a fairly low-level evaluation of individual words or phrases. In contrast, the structural cohesiveness (e.g., unrelated information), internal consistency (e.g., contradictory information), and informational completeness (e.g., omitted information) standards were regarded as macrostructure standards because they require integration of larger segments of text. Subjects in the treatment groups were tested at the end of the training session, whereas the control group participated only in the test phase. All three groups were tested again two and a half weeks later. For both test phases, subjects were asked to read and evaluate passages containing problems requiring the use of all six standards. They were told that the passages contained different kinds of problems; they were not informed about the specific types of the problems, however. The results indicated that students were more likely to identify problems of the types on which they were instructed, but both treatment groups identified more noninstructed problems than the control group. Moreover, the effects of instructions were maintained over time. Finally, the results also showed that although good readers outperformed average readers, both groups benefited from training in both conditions. Thus, the major contribution of this study, concluded the researchers, lies in its demonstration of generalization and maintenance of standard use when students were trained to evaluate their comprehension using multiple standards of evaluation. Although the results of this study illustrate the positive effects of training, one should be reminded that only average and above-average readers were included in the study; it is not clear whether truly poor readers would benefit from the same type of intervention.

While most of the comprehension monitoring research has contrasted good and poor readers, a number of studies have examined comprehension monitoring skills of learning disabled students. For example, Bos and Filip (1984) asked seventh-grade learning disabled and average students to read expository passages containing inconsistencies under a standard condition and a cued condition. They found that average readers used comprehension monitoring skills to detect text inconsistencies regardless of the condition, whereas learning disabled students activated comprehension monitoring strategies only when cued to do so. The results were interpreted as supporting Torgesen's (1980) characterization of learning disabled students as inactive learners.

In support, Chan, Cole, and Barfett (1987) also found a production deficiency in comprehension monitoring in learning disabled students. Matched on word-recognition skills, learning disabled students (mean age 11 years) and regular third-grade students (mean age 8 years), were required to read stories, some of which contained inconsistencies under a general instruction condition or a specific instruction condition. In both conditions, participants were alerted to the presence of embedded errors. In addition, students in the specific instruction condition were explicitly informed of the rationale for judging a passage as internally consistent and were shown how to use a cross-referencing technique to evaluate consistency. Both performance (underlying inconsistent sentences) and verbal (judging consistency of passages) measures were used. Comprehension competence was also measured. The two instruction conditions had similar effects on regular class subjects' performance; the specific instruction condition did not significantly improve their performance. In contrast, LD subjects' comprehension monitoring as well as comprehension performance was significantly better in the specific than in the general instruction condition. The researchers suggested that the performance discrepancy between LD and regular class students in the specific instruction condition may be related to differences in chronological age. On average, LD subjects were two to three years older than regular class subjects. It seems likely that under specific instructions, LD subjects were able to apply comprehension monitoring skills more efficiently than younger average readers because of experience and maturity. Of special interest were the high correlations (ranging from 0.65 to 0.74) obtained between the measures of comprehension monitoring and comprehension competence. Particularly, the superior performance in comprehension monitoring of LD subjects in the specific instruction condition was matched with a corresponding superior level of comprehension competence, indicating that higher reading comprehension achievement was associated with improvements in comprehension monitoring skills.

Most of the error detection studies reviewed above have focused on the reader's awareness of comprehension failure but made little attempt to examine the reader's employment of repair strategies to overcome comprehension failure. However, the need for investigating both the monitoring process as well as the use of strategies in this process has been revealed in the recent trend of error detection research. This is illustrated by studies carried out by August, Flavell, and Clift (1984), Grabe and his associates, and Zabrucky and her colleagues.

In an effort to examine both the monitoring process and the use of strategies, August, Flavell, and Clift (1984) asked fifth-grade skilled and less skilled readers to read five narrative stories page by page on a microcomputer screen. In three of the five stories, a passage of the story was deliberately omitted to create inconsistency. Skilled readers significantly detected more errors than did less skilled readers, as evidenced by verbal reports, longer reading times and number of lookbacks. These group differences could not be attributed to differences in nonverbal intelligence, decoding skill or ability to recall crucial story information because no differences were found in these areas between the two groups. However, the authors cautioned other researchers about the interpretation of these results. They argued that although there were group differences, less skilled readers did show minimal detection as indicated by on-line measures (longer reading time or lookbacks at the inconsistency). Moreover, skilled readers' performance was not at the ceiling level. These findings were interpreted as evidence that children, including the less skilled ones, process information in a constructive manner but the processing may not result in conscious awareness of noncomprehension or they may not know how to interpret such awareness. The authors concluded that not only less skilled readers, but also skilled readers, might need instruction in comprehension monitoring.

In addition to the use of computer programs, another approach to obtaining on-line information of readers' comprehension monitoring is analysis of eye movement patterns. The study carried out by Grabe, Antes, Thorson, and Kahn (1987) was one of the few studies that have combined the eye movement research technique with the error detection paradigm. In the Grabe et al. (1987) study, university students read expository paragraphs with or without internal inconsistencies while their eye movements were being monitored. Subjects in the uninformed condition were told to prepare to answer a comprehension question that would follow each paragraph, whereas subjects in the informed condition were asked to find and report contradictions as well as answer comprehension questions. Analysis of eye movement patterns revealed that subjects in both conditions adjusted their eye fixations when they first encountered contradictory statements in the text, providing evidence of spontaneous comprehension monitoring in uninformed subjects. However, informed and uninformed subjects did differ in their subsequent reading strategies, with the informed group displayed more rereading behavior.

More recently, Grabe, Antes, Kahn, and Kristjanson (1991) conducted a similar study with an intention to also examine the effects of error types (i.e., internal versus external inconsistencies) and developmental differences between adolescents and adults. College students and seventh-grade students served as subjects. Similar to their previous investigation, eye movement data in this study demonstrated readers' differential response to intact and error-inserted paragraphs; contradictory statements were processed more slowly than intact statements. With respect to the effect of age, informed adult readers were significantly more accurate in detecting and describing the external inconsistencies than adolescent readers. However, no age difference was observed in the detection of internal contradictions. In terms of instruction effects, both reader groups in the informed condition engaged in more second pass reading but adolescent readers also spent more time on first pass adjustments when instructed to search for errors. In short, as demonstrated by Grabe and his associates, the eye movement research technique has great potential for studying comprehension monitoring processes and strategies. Studies of this type, however, have been relatively rare.

Zabrucky, Moore, and Ratner (1985) also attempted to obtain more conclusive evidence of comprehension monitoring in children by using both on-line (performance) and off-line (verbal) measures. Second graders differing in reading ability were required to read stories, some of which contained informational inconsistencies. They were told to underline inconsistencies (a performance measure) as well as to rate passage comprehensibility and express liking of the passages (verbal measures). The investigators hypothesized that poor readers would adopt a decoding-oriented approach to comprehension and therefore performance and verbal measures would be related for the good but not poor readers. The results were as expected. In light of these findings, they suggested caution when interpreting studies using verbal measures such as rating of comprehensibility to assess comprehension monitoring. Of more concern were the overall "no difference" results (except for self-reported liking of congruent stories) found between good and poor readers. Also, error detection rates were far below ceiling for both reader groups. The researchers, however, did not offer many explanations regarding the "no difference" results although they were not consistent with those of most previous studies.

In another study, Zabrucky and Ratner (1986) presented third and sixth graders with consistent or inconsistent passages sentence by sentence. They assessed the subjects' monitoring process with on- and off-line measures (reading times and verbal reports) and strategy use by measuring lookback during reading. While students of both grades read inconsistencies more slowly than intact information, sixth graders were more likely to look back at inconsistencies, and reported more inconsistencies after reading. Data analysis reflected that on- and off-line measures of comprehension monitoring were not related to each other. Such a finding suggested, the authors concluded, that different measures of comprehension monitoring may each be assessing a different component of monitoring and that different levels of monitoring ability may exist in children of different ages. Therefore, it is important to treat comprehension monitoring as a multidimensional process.

Finally, it should be mentioned that the error detection task has also been used as a measure to evaluate effectiveness of metacognitive instruction programs. The intervention programs carried out by Paris and his associates (Paris, Cross, & Lipson, 1984; Paris & Oka, 1986), Palincsar and Brown (1984), and Mulcahy and his research team (Mulcahy, 1991; Mulcahy, Peat, Andrews, Clifford, Marfo, & Cho, 1989) are some examples. Whereas the programs of the Paris group and the Mulcahy group will be discussed in a latter section, the results of the Palincsar and Brown program are described here. Palincsar and Brown (1984) reported two instructional studies directed at the comprehension-fostering and comprehension-monitoring activities of middle school students. In these studies, seventh-grade poor comprehenders were taught to use four strategies: summarizing, questioning, clarifying, and predicting, both to make cognitive progress in reading and to monitor the progress. The instructional method, referred to as reciprocal teaching, involved a dialogue between the instructor and students that was structured by the use of the four strategies and focused on expository text. An array of outcome measures, including error detection, question prediction, text summarization, importance rating, as well as criterion and standardized comprehension tests, were used to determine the effectiveness of reciprocal teaching. The results indicated that reciprocal teaching was a powerful method for improving comprehension monitoring skills as well as comprehension performance, suggesting that metacognitive instruction can be applied in classroom instruction with very favorable results.

Summing up of evidence, the findings of comprehension monitoring studies utilizing the error detection paradigm are quite convergent in reflecting that age and reading ability have been positively correlated with error detection rates on a variety of on-line and off-line measures. It has also been observed, however, that older, better readers and even college students perform far below ceiling levels. To address the possible problems associated with this phenomenon, the recent research trend of the error detection work in reading reveals the needs for operationalizing comprehension monitoring as a multidimensional construct including process and strategy aspects, employing multiple measures of comprehension monitoring, clarifying standards for evaluating comprehension, and linking comprehension monitoring measures with reading competency measures.

3.2.2 Data from behavioral indicators

In addition to the error detection paradigm, comprehension monitoring has also been investigated using other on-line processing measures such as analysis of oral reading behavior or observation of nonverbal indicators. This type of research, like most early error detection studies, focuses on gathering evidence of monitoring with little attention to the strategy aspect of the monitoring process.

Several studies of oral reading have provided evidence concerning ongoing comprehension monitoring in children of different ages and reading abilities. For example, Clay (1973) in a study involving beginning readers, found that above average readers self-corrected 33% of their reading errors, while below average readers spontaneously corrected only 5% of their errors. Through the use of protocol analysis, Kavale and Shreiner (1979) reported that sixth-grade average readers, as compared to above average readers, showed greater incidence of meaning-distorting errors and were less likely to make spontaneous error corrections.

In the Paris and Myers (1981) study reported earlier in the knowledge section, the researchers also utilized oral reading of passages containing anomalous words and phrases to examine spontaneous comprehension monitoring in fourth-grade readers. They found that poor readers did monitor their comprehension but did not evaluate anomalies to the same degree as good readers, and that poor readers' monitoring behavior reflected their tendency to focus on the decoding aspect of reading.

Further evidence was offered by Bowey (1986), who presented fourth and fifth-grade children with an oral reading task and observed their syntactic awareness as reflected in their ability to correct deviant sentences. Significant correlations were found among measures of syntactic awareness, comprehension monitoring, and reading comprehension performance, even with general verbal ability effects covaried and text decoding effects controlled.

Overall, the results of these studies suggest that good and poor readers differ in comprehension monitoring during oral reading, both in types of errors made and in likelihood of spontaneous self-correction. As a research and assessment technique, analysis of oral reading misuses may prove useful with less mature readers who are more likely to have greater oral reading experiences in beginning reading instruction (Lupart, 1984).

However, as silent reading experiences become dominant in later school years, this oral approach may not be appropriate for investigating comprehension monitoring behavior in more mature readers, i.e., high school or college readers.

Another approach to obtaining information about ongoing comprehension monitoring is through observation. For example, in the Flavell et al. (1981) study discussed earlier, children's behavior in performing block-building tasks was video-taped and the tasks were later analyzed for nonverbal indicators of comprehension monitoring (e.g., shrugging shoulders, rolling eyes, shaking head, making faces, etc.) during listening. The results showed that kindergartners, though unable to verbalize their feelings of noncomprehension, did display facial and behavioral signs of comprehension monitoring.

Paris and Myers (1981) also found that good fourth-grade readers demonstrated more comprehension monitoring behavior such as underlining, taking notes or looking words up in a dictionary when they were reading.

As pointed out by Baker and Brown (1984a), "the advantage of the observation technique is that it can provide evidence of comprehension monitoring in situations where verbal difficulties or memory limitations might otherwise yield negative results" (p. 25). However, it should be noted that many monitoring activities cannot be overtly observed and accurately recorded. Therefore, it is important to supplement the behavioral data (e.g., facial expression, gestures, note taking, etc.) with additional measures such as reading times and eye movement patterns.

3.2.3 Data from performance prediction studies

Several investigations have used performance predictions or ratings as their main index of comprehension monitoring. The rationale is that if readers monitor their comprehension, they should be able to predict or judge their own comprehension performance. The study reported by Forrest-Pressley and Waller (1984) typifies this approach. In one part of the study, third- and sixth-graders were asked to predict their own comprehension accuracy. The match between readers' confidence ratings and correctness of answers to comprehension questions indicated that younger and poor readers were less successful at predicting their comprehension performance, reflecting their less efficient skills at evaluating their understanding.

Mize (1980) also examined the relationship between comprehension performance and feelings of understanding. The researcher presented seventh-graders with comprehension passages and asked them to predict their general success in answering questions before and after reading, and to judge the correctness of their answer to each question as well. Contrary to the findings of the Forrest-Pressley and Waller (1984) study, the results indicated that even good readers appeared unaware of their own degree of comprehension.

Support for Mize's (1980) findings was provided by Pressley and his associates (e.g., Pressley & Ghatala, 1988; Pressley, Ghatala, Woloshyn, & Pirie, 1990) in their studies with adult readers. In one study, Pressley and Ghatala (1988) asked university students to respond to three kinds of multiple-choice items: reading comprehension, vocabulary opposites, and analogies. The students then rated the likelihood that they had answered correctly to each item. The results showed that accuracy of students' confidence ratings was above chance for all three kinds of tests, suggesting some awareness of performance. Monitoring of performance on noncomprehension items (i.e., opposites and analogies), however, was much better than on the comprehension items. The most striking finding was that students appeared to be overconfident of their incorrect responses, and this trend was most evident with respect to their confidence ratings of the comprehension items.

In another series of experiments, Pressley, Ghatala, Woloshyn, and Pirie (1990) examined the influence of question format on adult readers' monitoring of text comprehension. In the first experiment, university students read passages, each followed by an adjunct short-answer or multiple-choice question. After responding to each question, they were asked to make a decision whether to move on to the next passage if they believed their answer was probably correct, or to look back in the text and redo the question if they thought their response was probably incorrect. It was found that students were more able to monitor their comprehension in the short-answer than in the multiple-choice condition, but they rarely look back following an error on a thematic question regardless of condition. In a second experiment, students were asked to rate their confidence in their responses to short-answer and multiple-choice questions. Consistent with the results of the first experiment, students exhibited overconfidence in their incorrect answers to thematic questions in both conditions. Moreover, their overconfidence was not related to their verbal ability. The researchers concluded that deficiency of main-idea comprehension monitoring was evident even in good adult readers.

It appears that the results of the studies using the performance prediction paradigm have been mixed. While there is evidence suggesting that good readers are more accurate at assessing their degree of comprehension, the results of some studies indicated that proficient adult readers are deficient in monitoring of main-idea comprehension. It is speculated that the inconsistent findings might, in part, be due to different task demands (e.g., comprehension for details versus comprehension for main ideas) involved in those studies. It is also possible that the discrepant findings might, in part, be related to the inherent limitations of the research paradigm. As noted by Baker and Brown (1984b), "the confidence rating approach to the study of comprehension monitoring has certain limitations" (pp. 362-363). First, young children tend to respond to questions positively, regardless of the truth of their assertions. Because of positive response bias, young children's confidence judgments may not accurately reflect their true feelings of understanding. Moreover, this technique does not directly assess ongoing monitoring behavior and strategies; confidence ratings are made *after* reading rather than *during* reading. Finally, this approach does not explore *how* the reader evaluates his/her degree of understanding; the reader's monitoring strategies and criteria for making the ratings are usually not revealed (Lupart, 1984). Nevertheless, if the self-rating technique is used in conjunction with other monitoring measures, it may provide a more comprehensive picture of the reader's comprehension monitoring behaviors. More importantly, the self-rating technique can be combined with attribution measures to reveal the relationship between metacognitive judgment and causal attributions for success and failure (Kurtz & Borkowski, 1984). Keeping its limitations in mind, the self-rating technique may be an appropriate approach to linking metacognitive measures with motivational measures.

3.2.4 Data from verbal report measures

In contrast to the performance prediction method, the self-report procedure seems more successful at disclosing information about how the reader evaluates his/her understanding. Although a reading task is usually involved, the subjective task of retrospection or introspection is the major characteristic of this type of study. The researchers take a very direct approach to the study of comprehension monitoring, asking readers to comment on their monitoring process, either in post-reading interviews or in think-aloud procedures.

While post-reading interviews in many ways are similar to metacognitive interviews reported earlier, some distinctions should be noted. Post-reading interviews are typically administered after the reader has completed a reading task; questions are tied to the reader's reflection on his/her behavior during reading. On the other hand, metacognitive interviews are usually administered to the reader without a reading task; questions tap the reader's knowledge about comprehension monitoring in hypothetical reading situations rather than in actual reading situations. In short, post-reading interviews assess the control components of comprehension monitoring, whereas metacognitive interviews assess the knowledge component of comprehension monitoring.

In fact, most of the error detection studies discussed before have included a verbal measure in their investigation of comprehension monitoring (e.g., August, Flavell, & Clift, 1984; Baker, 1979, 1985; Markman, 1977, 1979; Winograd & Johnston, 1982). In these studies, after an error detection task was presented, readers were probed to recall what they had read and report any error detection. This type of probed recall can be regarded as one type of post-reading interview. However, since the focus is on probing error identification, information about monitoring activities is quite limited.

Still some other studies have utilized the post-reading interview format to reveal information about monitoring activities during reading. For example, Paris and Myers (1981) examined comprehension and memory skills of fourth-grade good and poor readers. In one experiment, subjects were asked to read a story, then participated in free recall of the story. Following the recall, they were asked to report their reading strategies by rating the usefulness of 20 reading strategies on a 9-point scale. The results indicated that poor readers were less aware of the detrimental influences of negative factors on comprehension and their reversed ratings (i.e., rating negative strategies as positive) were associated with poorer recall performance. According to the researchers, the patterns of poor readers' ratings suggested that they may adopt decoding rather than meaning construction as goals during reading and are less accurate in applying monitoring skills to resolve comprehension failures.

Working with adults, Hare and Pulliam (1980) asked college students to read an expository text and think about their reading behavior. After reading, participants were required to write down how they read the text. The investigators found that four behaviors were associated with reading achievement: reading for meaning, rereading, selective reading, and adjusting reading speed. Using the same self-report retrospective paradigm, Hare (1981), in a subsequent study, found that the ability to discuss reading problems and strategies, the quantity of comprehension monitoring comments, and the number and kinds of strategies employed were all correlated with reading fluency.

To test the effects of processing-reporting distance on completeness of reports of reading and summarization activities, Garner (1982) asked college students to read and summarize an expository text. Half of the subjects reported their thoughts and activities immediately after task completion, while the other half of the subjects reported two days later. The same-day summarizers reported more cognitive activities and included less irrelevant events than did the delayed-report summarizers. These results demonstrated that accuracy of verbal reports varies with the interval between processing and reporting, indicating that memory failure might be a particular problem for post-reading verbal data.

To reduce the memory problem associated with the post-reading interview method, some researchers have adopted the concurrent verbalization think-aloud procedure as an alternative to obtain information about on-going comprehension monitoring. Representative studies are those conducted by Olshavsky (1976-1977, 1978), Garner and Alexander (1982), and Hare and Smith (1982), among others.

In Olshavsky's (1976-1977) first study, tenth-grade readers were presented with a short story and required to say aloud what they were thinking when they reached the end of a clause signalled by a red dot. Through analysis of the protocols, ten frequently used comprehension strategies were identified. Of particular interest were the two strategies related to the monitoring of comprehension: recognition of comprehension failure at the word and clause levels, and remediation of comprehension failure at the clause level. Both good and poor readers utilized similar strategies such as rereading, inferential reading, using contextual cues, etc., and strategy differences between the two reader groups were minimal. In a later study, Olshavsky (1978) investigated eleventh-grade readers' comprehension monitoring in passages of increasing difficulty. Good and poor readers both decreased their use of strategies as passage difficulty increased. Although Brown (1980) suggested that readers may become more strategic in processing information when they encounter difficulties in understanding, the results of this study indicated that if the text is too difficult, a breakdown of strategy use would be the result due to frustration.

Following Olshavsky's investigations, Garner and Alexander (1982) asked college students to read an expository text and be prepared to answer a question after reading. During reading, they were required to stop four times to think aloud, in writing, about how they were reading. Students who reported a question-predicting strategy were more accurate in answering the post-reading question than those who did not report such a strategy. The researchers suggested that the superior performance of the question formulators could be attributable to either a general active style of reading or activation of relevant strategies.

Also working with adults, Lupart (1984) used the think-aloud method and cloze tests to investigate college readers' strategies to resolve comprehension difficulties while reading expository materials. Analysis of the protocols revealed that participants, in the process of monitoring their comprehension, identified ideational, relational, and mnemonic difficulties and demonstrated a variety of remedial strategies. The author reported that the multi-interactional type of remedial actions (e.g., integrating prior knowledge with text information) was most highly associated with both successful resolution of comprehension failures and reading performance.

Most of the think-aloud studies have been conducted with adults. There are, however, some exceptions. Hare and Smith's (1982) study with seventh graders is one example. In this study, the subjects were required to read a narrative or expository text of about 250 words. They were asked to stop after reading about 50 words and think aloud their reading and studying strategies. Various strategies, such as rehearsing, rereading, skimming, adjusting reading speed, and imagining, were identified. Among these strategies, rereading was the strategy most frequently reported.

Still another exception was the study by French (1985) with adolescents with mild mental handicaps whose reading level was about grade four to five. In one part of his study, French utilized the think-aloud method to assess the subjects' strategic behavior while reading expository materials. A variety of strategies were found, but strategy use was not consistently effective or appropriate.

Although the think-aloud technique may reduce the likelihood of memory failure, which is a problem for most post-reading interviews, the use of this procedure also has certain limitations. First, like the interview method, the use of the think-aloud procedure heavily demands the subject's fluent verbalization. Thus, little of this type of research has been attempted with young children whose language skills are not yet fully developed. Of more concern is the problem of processing disruption. It seems very difficult to control the effect of deliberate verbalization on task completion. As noted by Garner (1987), moving thought to language may require different processing routines and the need for additional processing capacities may interrupt normal processing. Nevertheless, while we may question the accuracy of the verbal data, the results of these self-report studies have furthered our understanding of the monitoring process and particularly have helped in the identification of specific monitoring strategies.

3.2.5 Data from cloze test studies

Another approach that has also yielded rich information on monitoring strategies is the use of the cloze procedure. In a cloze test, the reader is presented with a passage containing word deletions and is required to fill in the deleted words. While the cloze procedure as a technique for assessing the reader's use of contextual cues has been reported in the literature for more than 30 years (Lupart, 1984), it is not until recently that it has been employed to examine the reader's use of reading and monitoring strategies. The study by Di Vesta, Haywood, and Orlando (1979) exemplifies this research orientation.

To investigate the use of lookahead and lookback strategies, Di Vesta et al. (1979) presented high school students and students from sixth, seventh, and eighth grades two types of cloze passages. In one type of passages, key words were omitted in the latter half of the passages so that a lookback strategy was needed to supply the missing words. In another set of passages, similar key words were deleted in the beginning half of the passages and therefore a lookahead strategy was required. While older and good readers performed equally well on both types of cloze tests, younger and poor readers performed less well when the use of subsequent text was required. The researchers concluded that searching subsequent text for clarification of information is a more mature strategy and that being able to use both lookahead and lookback strategies is an important development in the ability to monitor one's comprehension.

Lupart (1984) and French (1985) also incorporated a cloze task in their investigations of reading and comprehension monitoring strategies. While Lupart claimed that both the think-aloud method and the cloze procedure are useful devices in assessing the strategic behavior of college readers, French reported that the employment of the cloze passages appeared sufficient to obtain a rich variety of information on the reading strategies utilized by adolescents with mild mental handicaps. Among the four types of strategy assessment: think-aloud passages, scrambled sentences, cloze passages, and main idea unit selection, French found that the cloze passage yielded most information about subjects' use of strategies.

The cloze technique has not only been used to assess individual differences in comprehension monitoring skills but has also been utilized to measure the effectiveness of training studies devised to improve comprehension monitoring skills in children. Paris and his research team (see, for example, Paris, Cross, & Lipson, 1984) conducted an instructional program called Informed Strategies for Learning (ISL) program with third- and fifth-grade classes for about half a year. During this period, trained teachers taught students in their classrooms a variety of strategies applied to their texts. Informed strategies for learning meant that teachers told students what strategies were, and how, when and why to use them. To evaluate the effectiveness of the program, cloze passages, error detection tasks, and standardized comprehension tests were used. While the cloze measure and the error detection measure yielded results of superior performance of the instructed students, the standardized comprehension measures did not. To explain the pattern of the results, Paris et al. (1984) contended that standardized comprehension tests are highly correlated with general intelligence measures and are relatively insensitive to variations in specific learning experiences. In contrast, argued the researchers, the cloze procedure and the error detection task are more appropriate measures used to assess comprehension monitoring experiences and use of specific strategies.

While the ISL program carried out by the Paris group focuses mainly on reading comprehension, the Strategies Program for Effective Learning and Thinking (SPELT) developed by Mulcahy and his associates (Mulcahy, 1991; Mulcahy, Peat, Andrews, Clifford, Marfo, & Cho, 1989) represents a more inclusive approach to teaching learning and thinking. Strategies are taught across all subject areas to elementary and junior high students. Initially, the teacher directly teaches cognitive and metacognitive strategies to students by demonstrating that organized, goal-directed, and efficient use of strategies increases one's ability to acquire, comprehend, and apply knowledge in various subject areas. Subsequently, instruction utilizing interactive methods like Socratic dialogue focuses on facilitating maintenance and systematic transfer of the strategic repertoire previously established across tasks and content areas. Finally, group or paired problem-solving techniques enable students to generate strategies on their own and solve problems independently. The ultimate goal of the program is to develop self-regulated learners. The SPELT program was evaluated in the context of a three-year longitudinal study with students initially in grades four and seven. Outcome measures of program effectiveness included a reading awareness questionnaire, error-detection task, cloze task, measures of affective perceptions, and standardized cognitive and achievement tests. Overall, the results indicated increased use of more effective cognitive strategies in reading and math for all participants regardless of grade or ability. In particular, results from both standardized achievement measures and strategy measures such as error detection and cloze performance demonstrated the effectiveness of the program in increasing reading comprehension performance for elementary students with learning difficulties.

In sum, the cloze procedure appears to be a useful research technique for investigating comprehension monitoring, particularly in regard to the reader's use of monitoring strategies. Cloze tests, however, are seen as somewhat removed from normal reading situations (Baker & Brown, 1984a). Therefore, it may be useful to employ the cloze technique as well as other measures which provide normal reading situations to investigate comprehension monitoring.

3.2.6 Data from other research techniques

In addition to the above mentioned approaches that have been used to study monitoring process and strategy use, there are several other research techniques that have been implemented in studies of comprehension monitoring. However, because these methods are not as commonly used as the above approaches, data gathered from these various procedures are grouped and reported in this section. Most of the studies have focused on the strategy aspect of comprehension monitoring.

As reported earlier, data from verbal reports and cloze tests have helped in the identification of various compensatory strategies used by readers to remedy comprehension difficulties. Among these "fix-up" strategies, the "lookback" or text reinspection strategy is the one that has received most attention (Brown et al., 1986).

The study by Alessi, Anderson, and Goetz (1979) represents one of the initial studies on the use of the lookback strategy. In this study, college students were asked to read an expository text presented on a computer and answer questions interspersed in the text. When the questions were answered incorrectly, the computer forced subjects to look back to relevant sections. The researchers reported that the induced use of the lookback strategy helped students resolve comprehension failures.

Following the Alessi et al. study, Garner and her associates started a series of studies investigating the use of specific reading and monitoring strategies in elementary and secondary school students. In their primary investigation, Garner and Reis (1981) asked students from grades four through ten to read a three-segment (three-page) story and answer questions after reading each segment. Some of the questions were based on very detailed information presented on previous segments and therefore required the reader to look back to previous pages for answers. Verbal and nonverbal indicators of monitoring and of lookbacks were recorded. It was found that poor readers from grades four through ten generally displayed failure to engage both in monitoring and in spontaneous use of lookbacks. On the other hand, good readers in grade six and seven demonstrated evidence of monitoring (i.e., recognition of comprehension difficulties) but did not spontaneously utilize the lookback strategy. Only good readers in grade eight exhibited both monitoring behavior and spontaneous use of lookbacks to remedy comprehension/memory failures. These findings led the researchers to conclude that in the developmental sequence of comprehension monitoring skills, the evaluation phase (i.e., recognition of comprehension obstacles) precedes the regulation phase (i.e., deployment of compensatory strategies) of comprehension monitoring.

Matching sixth-grade learning disabled readers with fourth-grade average readers on reading level and non-verbal IQ, Thomas (1984) utilized a reading task similar to that of Garner and Reis (1981), to compare the two reader groups on recognition of miscomprehension, and knowledge and use of the lookback strategy. While average readers were more cognizant about their comprehension failures, no significant differences were found between the two reader groups in terms of knowledge and use of the lookback strategy. Both groups displayed good verbal knowledge of the lookback strategy, although neither group had attained a high degree of proficiency in using the strategy. Considering the reading level of the subjects in this study, the findings seemed to be in line with Brown's (1980) observation that "planful strategic behavior in face of school tasks does appear to be relatively late in developing" (p. 457).

Using a tutoring task, Garner, Wagoner, and Smith (1983) observed good and poor sixth-grade readers' use of strategies as they assisted fourth graders in answering questions after reading an expository passage. Some of the questions were text-based in that the answers were available in the text. Other questions were reader-based in that the reader had to integrate text information with his/her existing knowledge to answer the questions. Good and poor sixth-grade readers were found to be different in three ways: frequency of encouragement of lookbacks, differentiation of text- and reader-based questions and appropriate use of lookbacks to answer questions, and amount of encouragement of strategic text sampling to locate answers. These results indicated that sixth-grade good readers were well aware of the usefulness of the lookback strategy for reading, as revealed in their attempt to teach the strategy to younger students.

Using fifth-graders as tutors and third-graders as confederates, Hahn and Smith (1983) attempted to replicate the Garner et al. (1983) study. The results were quite similar; good fifth-grade readers encouraged third graders to use lookback and strategically sample text to answer questions.

Assuming that a strategy is actually a sequence of skills and that readers at different achievement levels may have acquired some, but not all, of the sequence, Garner, Macready, and Wagoner (1984) again used the tutoring paradigm to examine the order in which the components of the lookback strategy are acquired. The investigators observed the tutoring behavior of good and poor fifth-grade readers as they worked with third-grade confederates. Both groups appeared to have acquired the components of the lookback strategy in such a sequence: undifferentiated rereading, text sampling, question differentiation (i.e., differentiation of lookback and non-lookback situations), and text manipulation (i.e., combining ideas across sentence boundaries) in searching for information. Poor readers, however, demonstrated fewer component behaviors than good readers. Specifically, poor readers tended to employ "undifferentiated rereading" of the entire text in all instances in which an answer to a question was elusive, and they rarely looked beyond a single sentence for information needed to answer a particular question. On the whole, the components of the lookback strategy disclosed in this study, the investigators suggested, provide empirical impetus to intervention research and perhaps eventually to instructional practice.

The studies reviewed thus far have shown that the lookback strategy is often not utilized, particularly by younger and less skilled readers. To investigate if students can be trained to use the strategy, Garner, Hare, Alexander, Hayes, and Winograd (1984) taught the lookback strategy to intermediate-grade students enrolled in a remedial reading clinic. During training, the students were explicitly taught why, when, and where to use text lookbacks. The results demonstrated that the instructed students not only used lookbacks appropriately but correctly answered more questions when using the strategy. An observation made during this investigation was that many students asked if they could refer back to text for answers, suggesting that they seemed to view the lookback strategy as "illegal" even in a no-test situation. The researchers concluded that the use of the lookback strategy can be improved with direct instruction, and that eliminating erroneous ideas about legality of strategy use may be a critical component of future intervention research.

More recently, Alvermann (1988) investigated the effects of spontaneous lookbacks and lookbacks induced by a graphic organizer on students' comprehension performance. Grade-ten students , whose self-perceived comprehension ratings matched their scores on a traditional reading achievement measure, were randomly assigned to one of the two groups. Students in the graphic organizer group read expository passages and answered comprehension questions with the aid of an graphic organizer for each passage, while students in the control group read the passages and answered the questions. The results showed that low-ability comprehenders in the graphic organizer group performed significantly better than low-ability comprehenders in the control group in terms of correct responses to lookback-only questions as well as all comprehension questions. In contrast, there were no significant differences between the two groups of high-ability comprehenders. The researchers argued that the graphic organizer provided an effective guide for the low-ability group to lookback to question-relevant material and thereby enhanced their comprehension performance. For the high-ability group, the researchers speculated that they had well-practiced strategies of their own and therefore profited less from the provision of the graphic organizer.

The foregoing studies have advanced our understanding of the knowledge, process, and strategy aspects of comprehension monitoring. However, as Brown (1980) noted, a reader's comprehension monitoring (e.g., his/her tolerance for feelings of failure to understand) is related to the importance of the perceived reading goal. It is to the literature on goal/motive and related motivational factors in comprehension monitoring that we now turn our attention.

3.3 Research on goal/motive and related motivational factors in comprehension monitoring

It is commonly believed that the reader's goal of reading has an important effect upon his/her desire to read, and acquisition of reading proficiency (Neyrinck, 1986). This particular view can be analyzed from two dimensions. The first dimension is related to the reader's conception of reading, while the second dimension is concerned with the reader's perception of the criterion task under a specific reading situation and his/her ability to adjust reading behaviors in response to different reading purposes. Research findings of readers' conceptions of reading has been discussed in the previous section concerning readers' metacognitive knowledge about reading, generally revealing younger/poorer readers' conception of reading as word-decoding and older/better readers' conception of reading as meaning-getting. It is, therefore, the second perspective of goal-related factors in comprehension monitoring that will be discussed here.

In an attempt to investigate the effect of goal orientation on reading behaviors, Rothkopf and Billington (1979) presented high school and college students with a twelve-page passage on a slide projector. The subjects controlled slide processing speed but they were not able to reinspect any previously seen slides. The results showed that the students who were instructed with goal orientations tended to spend more time reading goal-relevant materials (i.e., looking for specific information) than irrelevant materials. The investigators also analyzed eye-fixation patterns and reported that goal-relevant sentences, compared to incidental sentences, resulted in over twice as many fixations. Further analysis of individual data, however, reflected large individual differences, indicating that there may be no single most effective processing style.

Children's ability to modify their reading behaviors to different reading purposes has been examined by Forrest-Pressley and Waller (1984). Third and sixth graders were asked to read stories for four different purposes: for fun, to think of a title, to skim, and to study. After reading each story, they took a multiple-choice comprehension test. The subjects' performance on the comprehension tests revealed their responses to different task demands. Third-grade poor and average readers seemed to read in the same way regardless of the task instruction. In contrast, third-grade good readers displayed differences in their comprehension performance between the skim and the study conditions. Furthermore, sixth-grade good readers differentiated between task demands to the greatest extent, demonstrating greater comprehension in the study condition than in all other conditions. These findings indicated that children's ability to adjust reading rates and strategies in response to various reading purposes increases with age and reading proficiency.

The previous two studies have demonstrated the effects of different goal orientations on the reader's reading behaviors. It should be noted, however, that in these studies the goals were operationalized by the researchers as criterion tasks imposed on the reader. From the perspective of the reader, as analyzed in chapter 2 on theoretical framework, one's reading behaviors are closely related to his/her own intentions of whether and how to meet those task criteria set by teachers/researchers. In this connection a brief review of research on motives and motivational factors in reading and learning is in order.

Defining metalearning as "students' awareness of their motives, and control over their strategy selection and deployment," Biggs (1985, p. 192) has developed two questionnaires to investigate students' motives and strategies for learning: the Learning Process Questionnaire (LPQ) for secondary students, and the Study Process Questionnaire (SPQ) for tertiary students. The two instruments are basically very similar, yielding information about students' approaches to learning and studying. Briefly, there are three major approaches: surface, deep, and achieving, each with a motive and a strategy component (see chapter 2, pp. 23-24, and for details, see Biggs, 1987b). The surface motive is to meet requirements minimally, and the surface strategy is to reproduce through rote learning. The deep motive is to actualize one's own interests, and the deep strategy to read widely and interrelate with previous knowledge. Whereas the achievement motive is to demonstrate one's excellence publicly, the achieving strategy is to behave as "model student". Biggs (1985, 1987b) reported a research series on the two questionnaires. Of particular interest among the findings were the correlations between locus of control, academic performance, and approaches to learning. It was found that the deep approach scores were consistent with internal locus of control and good academic performance, while the surface approach scores were associated with external locus of control and poor academic performance. Another important finding relevant to the present discussion was that the deep-motivated and high achieving students tended to choose strategies that were congruent with their motives and to deploy them effectively, whereas the surface-motivated students tended to adopt strategies that were not cognate with their motivational state, although their strategies were sometimes effectively used. To these students with surface motives, strategies appeared to be tactics, meaning that they were task-specific and were used with little or no metacognitive awareness involved. These findings generally supported the notion of motive-strategy congruence, that when metalearning is involved, students' motives for learning help determine the strategies they employ. On the whole, the work of Biggs on student approaches to learning underscores the close relationship between motives and strategy deployment. The interaction between one's motivational state and metacognitive skills, therefore, deserves our further analysis.

Research on students' motivational processes has consistently revealed important differences between good and poor readers (Ryan, Ledger, Short, & Weed, 1982; Licht, 1983). Compared to good readers, poor readers appear to have lower self-esteem (e.g., Boersma & Chapman, 1981; Winne, Woodlands, & Wong, 1982), lower expectations for success (e.g., Pearl, Bryan, & Herzog, 1983), and are more likely to attribute failures to insufficient ability than to inadequate effort (e.g., Butkowsky & Willows, 1980). Most of the early work in the area of motivation has not obtained metacognitive measures. Similarly, most metacognitive studies have not included motivational variables for investigation. However, the need for investigating both metacognitive and motivational aspects of academic performance has been revealed in the recent trend of educational research. The studies carried out by Borkowski and his associates are some examples.

In a study with first and third grade children, Kurtz and Borkowski (1984) examined the effects of strategy and metacognitive training on memory performance. The subjects were assigned to three training conditions: task-specific strategy training, general metacognitive training, or both strategy and metacognitive training. Following training, they were given memory tasks and attributional questions which tapped their perceptions of the causes for specific success and failure outcomes. Post-training scores revealed that strategy training was highly successful, although general metacognitive instructions did not yield significant effect. Of particular concern was the interactions among cognitive, metacognitive, and motivational variables. Among strategy-trained subjects, those who attributed success to controllable factors such as effort were both more strategic and higher in metamemory knowledge than those who attributed task outcomes to noncontrollable factors such as ability or task characteristics. The results were interpreted as showing that "children with prior dispositions to attribute success to effort and with good metamemory knowledge receive greater cognitive and motivational boosts from strategy training than other children" (p. 352). The researchers suggested that further research is needed to examine the interactive nature of knowledge, process, and motivational variables as determinants of strategy transfer.

In another study, Reid and Borkowski (1987) attempted to reshape the attributional beliefs, improve self-control, and increase metacognitive awareness of hyperactive children, 65% of whom were also learning disabled. The subjects were divided into three treatment groups which received strategy training, self-control and strategy training, and self-control and strategy plus attribution training. The results indicated that the children in the self-control and strategy plus attribution group showed greater strategy transfer effects, more effort-related attributions, and heightened self-control when contrasted with the children in the other two conditions. The study, according to the researchers, underscores the importance of integrating metacognitive instructions with attribution training to produce long-term changes in cognitive and metacognitive systems.

Further evidence of the importance of including attributional components in strategy training was offer by Carr and Borkowski (1989) in their intervention research on underachievers' reading comprehension. Third to fifth grade underachievers were randomly assigned to one of the three conditions. One group received training in strategy plus attribution, another group received training in strategy only, while the third group served as the control group. Results of the study showed that the two training groups exhibited significantly greater metacognitive awareness than the control group. The most intriguing finding, however, was that the strategy plus attribution group outperformed the other two groups in terms of strategy use and reading performance, and displayed significant increase in effort-related attributions. The study thus demonstrated the merit of the addition of attributional components to strategy training.

More recently, Carr, Borkowski, and Maxwell (1991) compared achieving and underachieving students on a number of motivational, affective, and metacognitive variables. Multiple measures of ability, attributions, self-esteem, reading awareness, and reading performance were employed. Structured equational modeling was used to test the relationships among motivational, affective and metacognitive components for achievers and underachievers. The results indicated that attributions, self-esteem, and metacognition interrelated in a similar fashion to predict reading achievement for both groups. Underachievers, however, differed from achievers in the relationship between ability and attributions; underachievers failed to associate achievement with their own effort and ability. The researchers concluded that the findings support a multidimensional view of underachievement, with personality and motivational factors interfacing with the development of efficient and effective cognitive and metacognitive skills.

While Borkowski and his colleagues in their studies have demonstrated the interwoven relationships between metacognition and motivational variables, no study to date has attempted to directly investigate motivational processes in relation to the reader's comprehension monitoring behaviors. It would seem that research is needed to assess the connections between motivational factors (e.g., attributional beliefs, patterns of motives, etc.) and comprehension monitoring among readers of different ages and levels of proficiency.

3.4 Chapter Summary

Studies investigating readers' knowledge of comprehension monitoring have shown that, compared to older and skilled readers, younger and less skilled readers seem to have misconceptions of reading and limited metacognitive awareness of comprehension monitoring. Younger and less able readers tend to maintain a decoding emphasis of reading and are less aware of the need and value of strategies for monitoring comprehension. Investigations concerning the process and strategy aspects of comprehension monitoring, carried out through a variety of research techniques, have consistently demonstrated that ability to monitor the comprehension process and to resolve comprehension difficulties through strategy implementation increases with age and reading proficiency. Although no study has directly examined motivational factors in comprehension monitoring, research on motivational variables in learning and remembering has revealed the interactive nature of metacognition and motivation. While the relationship between various aspects of comprehension monitoring and reading competence has been indicated in the foregoing research review, methodological flaws associated with this body of research have limited our interpretation of the results. This review of empirical research thus leads to an analysis of methodological approaches typically utilized in studies of comprehension monitoring which will be detailed in the following chapter.

4. METHODOLOGICAL CONSIDERATIONS

While different techniques have been utilized to investigate various aspects of comprehension monitoring, two approaches -- metacognitive interview and error detection paradigm -- have most often been cited in the research literature and will be discussed here.

4.1 Metacognitive Interview

The interview technique has been the most frequently used method for examining metacognitive knowledge in readers of various ages (Garner, 1987). The rationale is, as Baker and Brown (1984b) note, that "one simple way of assessing what children know is to ask them" (p. 358). Although verbal reporting has long been held as an important part of psychological investigation (Afflerbach & Johnston, 1984), researchers have raised a number of questions concerning the validity and reliability of verbal-report data from interviews (Nisbitt & Wilson, 1977; Cavanaugh & Perlmutter, 1982; Garner, 1987).

One basic methodological concern about metacognitive interviews is the *accessibility* of one's own cognitive processes. Many psychologists argue that people may not have direct access to higher order cognitive processes such as those involved in memorization, problem-solving and comprehension. Nisbett and Wilson (1977), for example, have cited several prominent psychologists from Neisser to Mandler to support the view that conscious awareness is limited to the products of mental processes and that the processes themselves are beyond the reach of introspection. White (1980), however, in his refutation of Nisbett and Wilson's work on the limitations to conscious awareness of mental processes, argues that Nisbett and Wilson have not clearly formulated their theoretical stance and that they have not succeeded in putting any hypothesis about consciousness to the test. First, White contends, to use consciousness as the criterion for making the distinction between product and process is arbitrary. Second, people tend to infer lack of consciousness of an action from reduced attention to perceptual feedback. White uses driving to illustrate the point: people often believe that the spell of driving is not done consciously because they cannot remember details of the road they have just been through, not because they cannot remember executing their actions. That is to say, people seem to confuse consciousness with automaticity of an action. For White, automatic does not necessarily mean unconscious, although automatic actions are often more difficult to describe. Furthermore, sometimes it is hard to determine the conscious level of one's cognitive state. As White points out, "Once we have started speaking we are no longer in a position to know whether, or in what sense, our utterance was 'done consciously', or whether its contents were conscious before they are uttered"(p. 107). In White's view, Nisbett and Wilson have not provided us with evidence about consciousness but make unwarranted assumptions about the relationship between consciousness and the process and the verbal report. Ericsson and Simon (1980, 1984), on the other hand, using an information-processing model of verbalization, contend that the studies cited by Nisbett and Wilson are consistent with their model in showing that people do have direct access to, at least, the intermediate stages of their mental operations (i.e., processes that have not yet become automatic). The problem concerning verbal data of cognitive processes, according to White (1980) and Ericsson and Simon (1980, 1984), then, does not particularly relate to accessibility of cognitive processes but to failure of memory for the processes.

Both White (1980) and Ericsson and Simon (1980, 1984) consider *memory failure* a major problem for verbal-report data of mental processes. Specifically, Ericsson and Simon believe that most intermediate results of people's mental operations are held in either short-term memory (STM, such as in the case of think-aloud tasks) or in long-term memory (LTM, such as in the case of retrospective interviews) and are accessible upon reflection.[1] Inaccurate and/or incomplete verbal reports of mental processes are usually due to inappropriate probing procedures which cause incorrect memory retrievals thus forcing people to use inferential processes to fill out and generalize incomplete or missing memories. To minimize memory confounds, the researchers urge reduction of the interval between processing and reporting and caution of the use of probing.

A third problem inherent in metacognitive interviews concerns subjects' *verbal ability*. Cavanaugh and Perlmutter (1982) point out that verbal reports are especially problematic when used with individuals having limited language skills. However, techniques such as using pictorial stimuli have been developed to reduce heavy verbalization demands. One solution relevant to the purposes of the present study is to use non-verbal measures to verify the consistency of interview responses. Miller and Bigi (1979), for example, used both verbal and non-verbal measures to assess the attentional knowledge of children from first, third, and fifth grade. First, the subjects were individually given an open-ended interview about their knowledge of attention used at home and at school. Two to three weeks later, the subjects were posed similar questions supplied with several possible answers (generated from the interview part of the study) from which they might choose. The second phase of the study was devised to minimize verbalization. The delay between testing was intended to prevent warm-up or carry-over effects of first-phase work on second-phase responses. Results from both phases revealed developmental differences favoring the older children in terms of greater awareness of various factors (i.e., interest, motivation, and concentration, etc.) as determinants of attention, although multiple-choice questions produced an overall higher level of responding among children of all ages. Thus, it would seem likely that the interview technique could be further strengthened through the addition of a multiple-choice questionnaire in a collaborative research context.

---

[1] It should be noted, however, that information stored in STM is generally more reliable. Once information has left STM, it may or may not be transferred to LTM and this will affect the accessibility of mental operations.

Another methodological point applying to metacognitive interviews relates to scoring of data (Meichenbaum, Burland, Gruson, and Cameron, 1985). In the case of open-ended interviews, verbal responses are usually reduced to certain metacognitive themes for quantitative analysis. Since this data reduction process is highly subjective, controversy over data analysis may exist. To reduce the problem of subjectivity, inter-rater agreement should be accessed.

Although the interview method has the above limitations, it also has certain advantages that other research techniques may not possess. As Afflerbach and Johnston (1984, p. 308) suggest, verbal reports have a number of advantages: (1) they provide support for the collection of converging data sources, (2) they provide veridical descriptions of cognitive processes which otherwise could only be investigated indirectly, (3) they enable access to the reasoning processes underlying higher level cognitive activity, (4) they are sometimes the only available avenue for historical/genetic analysis of mental processes, and (5) they allow analysis of the affective components of reading processes.

For the purposes of the present research, the interview approach is primarily used to assess the reader's general knowledge base of comprehension monitoring. It seems that adopting other research techniques such as think-aloud or peer-tutoring as alternatives to interviews would be inappropriate because those techniques, if used, are task-specific and are essentially tapping the control dimension of comprehension monitoring. As a result, the interview method, though not free from criticism, appears to be the only available avenue for analysis of the reader's existing knowledge base of comprehension monitoring. Being aware of its limitations (e.g., the reader may not report all that he/she knows about comprehension monitoring), minimizing its shortcomings (e.g., use of a careful probing procedure, inclusion of inter-rater agreement, collection of converging data), and maximizing its advantages (e.g., analysis of motivational components of comprehension monitoring), the interview method may provide us with important data about the knowledge and motivational aspects of comprehension monitoring. As Ericsson and Simon (1980) submit:

> ... verbal reports, elicited with care and interpreted with full understanding of the circumstances under which they were obtained, are a valuable and thoroughly reliable source of information about cognitive processes. (p. 223)

4.2 Error Detection Paradigm

The error detection task has been the most popular research paradigm used to investigate readers' comprehension monitoring processes and strategies. Although the findings of most error detection studies, as previously shown, are quite consistent in revealing that detection of comprehension confusions has been positively correlated with age and reading achievement, the overall moderate to low error detection rates found in many studies have led several researchers to question the utility of the error detection paradigm as an approach to assessing comprehension monitoring.

Winograd and Johnston (1982), for example, in their much cited article identify five major difficulties in the use of the error detection task:

1. *Multiplicity of confounders:* It is possible that subjects' failure to report errors is due to factors other than poor comprehension monitoring, such as lack of prior knowledge, memory failures, authority-questioning reticence, and use of inferential "fix-up" to resolve comprehension difficulties.
2. *Lack of explicit evaluation standards:* Researchers assume that subjects' purposes for reading match their own, but it is possible that subjects' criteria for comprehension do not match researchers' criteria.
3. *Variety of target errors:* Target error can vary in kind (e.g., omissions, inconsistencies, spelling errors, grammatical errors, etc.), placement (i.e., high or low in the text structure), and magnitude (e.g., blatant vs. implicit). Possible interactions between error types and individual differences need to be considered.
4. *Inadequate use of probing:* The use of probes to elicit subjects' awareness of errors may cause problems because (a) subjects may become impatient with the redundancy of the probes, and (b) the assumption of equal interval probes in the scoring procedure is unwarranted (i.e., the assistance distance between probes may not be the same).
5. *Overreliance on self-reporting:* It is difficult to determine the accuracy of subjects' verbal reports about their detection of errors; solely use of verbal measures may not be reliable.

In addition, another criticism levelled at the error detection task is its *lack of ecological validity;* readers do not typically encounter confusions in their reading material. Baker and Brown (1984a), however, argue against this position because "textbooks are published routinely that contain sections which can be only described as poorly organized, ambiguous, and inconsistent" (pp.27-28). In other words, sensitivity to such problems is required even in normal reading situations. However, it is difficult for researchers to observe signs of internal processing difficulty in ordinary settings. Consequently, the technique of introducing confusing elements into a text and then examining the effects of such confusions on readers' processing behavior seems justifiable. Since there is some control over the comprehensibility of the text, researchers are able to make specific predictions as to when and where readers should experience difficulty if they are monitoring their comprehension. Given the utility of this approach in this aspect, it may not be wise to totally reject the error detection paradigm. What remains is how we can resolve or minimize the methodological difficulties like those voiced by Winograd and Johnston (1982).

Garner (1987), in view of the criticisms raised by Winograd and Johnston (1982), offers five suggestions for improving the error detection procedure to investigate comprehension monitoring.

1. *Explicit directions to locate errors:* Synthesizing the results of recent error detection studies, Garner comments that simply informing subjects of the presence of errors improves error detection performance. The reason is two-fold. First, as language users in the real world, people are used to ignoring some of the problems with the message they receive. Second, readers often assume text to be a formal, autonomous, finished piece to be held in awe. As a result, readers are unlikely to report comprehension obstacles unless they are encouraged to do so. Giving explicit directions to locate errors may diminish readers' reluctance to report comprehension obstacles and thus minimize one possible confounding variable --authority-questioning reticence.
2. *Inclusion of blatant errors:* Garner contends that monitoring performance is affected by degree of message inadequacy. More effective comprehension monitoring is expected for highly ambiguous messages than for the slightly ambiguous ones. She therefore urges use of blatant errors from maximally disruptive categories (e.g., informational inconsistencies) to enhance error detection performance.
3. *Use of relatively naturalistic research settings:* Since readers' comprehension monitoring performance on error detection tasks is much affected by task demands and conditions under which they perform the tasks, Garner admonishes researchers to study children's comprehension monitoring in natural settings as much as possible. She cites the study by Revelle, Wellman, and Karabenick (1985) to demonstrate the advantages of an "ecological valid" study. Revelle et al. studied preschool children's comprehension monitoring using a "quasi-naturalistic" method by which they mean that task, stimuli, and situation were simple and familiar to the children. Each child

participated in sand box play and in preparations for a pretend tea party with an adult. During the play sessions, the adult made a series of requests of the child, some of which posed comprehension difficulties. In contrast to many of the studies in which young children were found to display minimal cognitive monitoring (e.g., Markman, 1977), Revelle et al. reported evidence of children as young as 3 years old evaluating messages before attempting to act on them. The researchers accounted for the discrepant results between their investigation and previous studies by pointing to the natural setting of their study. In light of the Revelle at al. study, Garner suggests that the use of relatively naturalistic research settings ensures the ecological validity of research and enables researchers to generalize findings from experimental work to real life situations.

4. *Use of nonverbal measures of detection:* Error detection has typically been assessed by some type of verbal-report measure such as a verbal response to a probe questions and/or verbal ratings of passage comprehensibility. As pointed out by Winograd and Johnston (1982), inadequate use of probing and overreliance on self-reporting are two problems inherent in the verbal-report method. To obtain reliable and valid information about readers' comprehension monitoring, Garner suggests inclusion of nonverbal measure of error detection. Particularly, use of on-line processing measures eliminates the memory-failure problem of verbal reports and allows accurate measure of subjects' reading times. In other words, both on-line (i.e., obtained while a subject is performing a task) and off-line (i.e., obtained after a subject has finished a task), verbal and non-verbal measures are needed to provide converging evidence of readers' comprehension monitoring processes and strategies.
5. *Provision of explicit evaluation standards:* Winograd and Johnston (1982) have suggested that subjects may use criteria different from those of the researcher to evaluate comprehension adequacy. Therefore, Garner proposes that it is important for the researcher to explicitly set the evaluation standard for adequate comprehension. Moreover, Baker (1984a, 1984b) argues that comprehension monitoring is a multidimensional process requiring flexible use of a variety of evaluation standards. Because different standards impose different cognitive processing demands, she notes, they differ in ease of application. In the case of error detection, the reader has to apply a lexical evaluation standard to detect a nonsense word, an external consistency standard to detect violations of prior knowledge, and an internal consistency standard to detect contradictions within the passage. If the reader fails to apply one standard thereby not noticing the corresponding problems, it does not mean that he/she does not evaluate his/her understanding along other dimensions. In order to provide a complete picture of

subjects' comprehension monitoring skills, suggests Baker, it is important to examine multiple standard use within a single setting. In short, provision of explicit evaluation standards may reduce some possible confounding factors (e.g., mismatch of reader-experimenter comprehension criteria, reader's use of inferential "fix-up" to resolve comprehension obstacles) while interpreting comprehension monitoring data.

It seems clear, in the foregoing discussion, that the error detection technique as a research paradigm has a number of advantages. First, it allows us to examine both the process (i.e., evaluation, as indicated by readers' identification of errors) and the strategy (i.e., regulation, as indicated by readers' use of lookbacks or other remedial strategies after detecting errors) aspects of comprehension monitoring. Second, it allow us to investigate readers' use of various evaluation standards. With the provision of explicit evaluation criteria, interactions between evaluation standards (i.e., error type) and individual differences can be analyzed. With both on-line and off-line measures included, possible confounding variables can be eliminated and converging data of readers' comprehension monitoring can be collected. In sum, the error detection task, if well designed, can offer us a unique opportunity to examine the complexity of comprehension monitoring in a multidimensional context.

4.3 Chapter Summary

Two major methodological approaches to the investigation of comprehension monitoring have been analyzed. The interview procedure is usually used for assessing the reader's metacognitive awareness of the reading task. The reader's perceived goals of reading, which are closely related to his/her motivational state, can also be studied through the interview procedure. With the addition of a questionnaire to minimize the confounding effects of verbal ability and to obtain converging data, the interview method may provide us with valuable information about the knowledge as well as motivational components of comprehension monitoring in readers of different abilities. With respect to the process and strategy dimensions of comprehension monitoring, the error detection task enables us to study the complexity of the evaluation and regulation phases of comprehension monitoring. With their limitations being acknowledged and minimized, the door of opportunity to utilize the advantages of these two approaches is accessed.

PART TWO:
THE RESEARCH

5. RATIONALE, DEFINITIONS, AND RESEARCH QUESTIONS

5.1 Rationale

As evident in the foregoing chapters, the conceptual notion of metacognition has gone through certain important changes. While the term metacognition was originally created to denote one's self-awareness or knowledge of his/her own cognitive activities, development in information-processing psychology appeared to emphasize the importance of how one controls his/her cognitive processing. During the past few years, however, attempts have been made to incorporate both the knowledge and control components into the current conceptualization of metacognition. While metacognition is now viewed as a superordinate term denoting one's knowledge and control of cognition in general, cognitive monitoring, on the other hand, is seen as one fundamental form of metacognition concerning one's knowledge and use of self-regulatory mechanisms in cognitive processing. Flavell has developed a global model of cognitive monitoring consisting of four components: metacognitive knowledge, metacognitive experience, cognitive actions, and cognitive goals. In view of Brown's work and recent research efforts to link metacognition with motivation, it is suggested that the goal component be modified to include relevant motivational factors.

Applying the notion of cognitive monitoring to the task of reading comprehension, comprehension monitoring then means cognitive monitoring in reading. Adhering to the modified Flavell model of cognitive monitoring, comprehension monitoring also consists of four components: knowledge, process, strategy, and goal/motive and motivational factors.

Turning from theory to research, recent years have witnessed the emergence of research on various metacognitive aspects of reading. The potency of comprehension monitoring as an important determinant of reading proficiency has been empirically demonstrated across a variety of investigations utilizing different research techniques. The general pattern of results indicates that reading ability/maturity is, strongly or moderately, related to skills of comprehension monitoring. However, methodological flaws associated with this body of research have limited interpretations of the results. Typically, studies of the knowledge aspect of comprehension monitoring have relied on readers' verbalizations in response to interview schedules of varying length. Such metacognitive interviews have not been corroborated by other measures. On the other hand, many investigations of the monitoring process and strategies have employed the error-detection paradigm with no control of confounding variables, evaluation standards, and verbal-response reliability. In addition, in most studies comprehension monitoring measures have not been obtained in conjunction with comprehension performance measures to examine linkage between comprehension monitoring behavior and comprehension performance.

Furthermore, in most cases information concerning each aspect of comprehension monitoring was obtained in an isolated manner, although a few researchers did attempt to link reflective (knowledge-based) measures with deliberate (process-based) measures. In this regard, Forrest-Pressley and Waller's (1984) observation is relevant:

> The relation of monitoring to strategy use has received even less attention than the knowledge/use issue, and the knowledge/ monitoring/use issue has been virtually ignored. (p. 121)

In other words, the literature was almost nonexistent with respect to the intention-knowledge-process-strategy relations, not to mention analysis of their interrelations with reading proficiency. It was therefore necessary to progress from the trend of isolated, piecemeal investigations to a systematic, comprehensive examination of the interrelationships among the components of comprehension monitoring and reading performance. To meet such a research need, the present investigation was developed.

First, in this research comprehension monitoring was conceptualized as a multidimensional process; all four components of comprehension monitoring were examined within a single research setting. Second, multiple dependent measures were used in order to obtain convergent evidence of comprehension monitoring. Third, comprehension monitoring indicators were measured along with comprehension performance measures. Specifically, the major purposes of this study were:

1. to examine individual differences in a group of sixth-grade readers in comprehension monitoring in four dimensions: (1) knowledge, (2) processes, (3) strategies, and (4) perceived goals/motives and attributional beliefs, via a structured interview and a parallel questionnaire, the Learning Process Questionnaire, and an error-detection task;
2. to explore the nature of the assessment techniques (i.e., verbal vs. non-verbal, off-line vs. on-line measures) necessary to assess the knowledge, process, strategy, and motivation components of comprehension monitoring;
3. To investigate how knowledge and goal/motive of comprehension monitoring relate to general learning motives and strategies; and
4. to investigate the interrelationships among the knowledge, process, strategy, and motivation components of comprehension monitoring, and the extent to which each component of comprehension monitoring relates to reading comprehension performance.

5.2 Definition of Terms

Most of the terms relevant to the present research have been elaborated and clarified in previous chapters. For reference purposes, the definitions of several key terms are briefly summarized as follows.

Reading comprehension

Reading comprehension is a complex cognitive process of decoding, integrating, reasoning, and inferring. This process, which involves both data-driven and concept-driven processing, occurs between the reader's interactions with the text and is accomplished through the generation of emergent understandings. In the present research, reading comprehension was operationally defined as performance on the comprehension subtest of Canadian Tests of Basic Skills and on reading comprehension questions of error detection passages.

Cognition

In the current research, cognition refers to effortful acquisition, retention, and use of academic knowledge. Accordingly, such terms as learning, remembering, understanding, and problem-solving in an academic context can be subsumed under the notion of cognition.

Metacognition

Metacognition involves thinking about one's own learning, remembering and understanding. The term, meaning cognition about cognition, *refers to one's knowledge and control of his/her own cognitive activities.* Integrating the views of Flavell and of Brown, metacognition involves two components. First, metacognitive knowledge, or knowledge about cognition, refers to one's knowledge about his/her own cognitive resources, about task demands, and about strategies needed to effectively perform a cognitive task. Second, metacognitive experience, or control/regulation of cognition, refers to one's ability to manipulate and regulate his/her own cognitive resources and strategies to ensure the successful completion of a task. These two components of metacognition are assumed to interact with each other as they influence one's cognitive activity.

Comprehension monitoring

There is a hierarchical relationship among metacognition, cognitive monitoring, and comprehension monitoring. Metacognition can be viewed as a superordinate term.Whereas cognitive monitoring is a one component of metacognition concerning the knowledge and use of self-regulatory mechanisms in general cognitive processing, comprehension monitoring denotes cognitive monitoring in oral or reading comprehension. For the purposes of the current investigation, *comprehension monitoring refers to cognitive monitoring in comprehension of connected discourse.* Specifically, comprehension monitoring consists of four components: knowledge, process, strategy, and goal/motive and motivational factors. Each component is defined as follows.

Knowledge of comprehension monitoring

Knowledge of comprehension monitoring refers to one's knowledge about himself/herself as a reader, the text he/she encounters, the reading task he/she faces, and the monitoring strategies he/she employs when he/she engages in reading. Accordingly, knowledge of comprehension monitoring can be divided into four categories: person, text, task, and strategy. Knowledge of personal strengths and weaknesses as a reader affects one's comprehension monitoring activities. Knowledge of task variables affects one's efficiency in adjusting his/her effort in response to task demands and thereby affects one's monitoring functions in reading. Awareness of various text structures influences one's comprehension monitoring mechanisms. Finally, knowledge of monitoring strategies is critical to the reader's resolution of comprehension obstacles.

Process of comprehension monitoring

Process of comprehension monitoring refers to the reader's keeping track of his/her current state of organizing comprehension. This process component of comprehension monitoring is equivalent to the *evaluation* phase of Baker's (1985) conceptualization of comprehension monitoring. In other words, process of comprehension monitoring denotes the reader's ongoing evaluation of his/her progress in comprehension including the reader's recognition/detection of comprehension failures/obstacles.

Strategy of comprehension monitoring

Strategy of comprehension monitoring refers to deliberate and planful actions used to assess one's level of comprehension or resolve comprehension difficulties.This strategy component of comprehension monitoring is equivalent to the *regulation* phase of Baker's (1985) conceptualization of comprehension monitoring. That is, comprehension monitoring strategies are actions that the reader utilizes to ensure continuous and smooth comprehension or to remediate comprehension failures once detected.

Goal/motive and motivational factor of comprehension monitoring

Goal/motive and motivational factor of comprehension monitoring refer to the reader's implicit or explicit objectives that initiate and maintain the reading endeavor and his/her motivational state when he/she engages in reading. The reader's perceived goals for reading are closely related to his/her metacognitive knowledge of reading and is also linked to his/her motives and interests for reading. His/her motivational state during reading can be reflected in his/her perceptions of the causes for specific comprehension success and failure outcomes.

On-line measures

On-line measures refer to measures obtained while a subject is actually performing a task.

Off-line measures

Off-line measures refer to measures obtained after a subject has finished a task.

In addition to the above terms, two important definitions, skilled sixth-grade readers and less skilled sixth-grade readers, were operationally defined within the subject section of Chapter 6 .

5.3 Research Questions

In view of the definitions of the above terms and in response to the purposes of this research as listed in the preceding session, the following research questions were formulated.

Research question 1 concerns *individual differences in the knowledge and goal/motive dimension of comprehension monitoring and the nature of assessment techniques in this dimension.*

Three subquestions were developed:

1a. Are there differences between skilled and less skilled sixth-grade readers in terms of their knowledge and goal/motive of comprehension monitoring as revealed in their interview responses?

1b. Are there differences between skilled and less skilled sixth-grade readers in terms of their knowledge and goal/motive of comprehension monitoring as revealed in their questionnaire responses?

1c. Which assessment technique (i.e., interview which requires heavy verbal demands vs. questionnaire which requires less verbal demand) assists in gaining more meaningful responses from the subjects?

Research question 2 ***examines how goals/motives and strategies of comprehension monitoring relate to general learning motives and strategies.*** Two subquestions were formulated:

2a. Are there differences between skilled and less skilled sixth-grade readers in terms of their motives and strategies of learning in general as revealed in their responses to the Learning Process Questionnaire (Biggs & Mulcahy, 1988, Canadian edition)?

2b. What are the relationships between sixth-graders' motives and strategies of learning in general (as assessed by the Learning Process Questionnaire, hereafter LPQ) and their goals/motives and strategies of comprehension monitoring in reading (as assessed by the interview and the questionnaire)?

Research question 3 ***concerns individual differences in the process dimension of comprehension monitoring and the nature of assessment technique sin this dimension.***

Three subquestions were formulated:

3a. Are there differences between skilled and less skilled sixth-grade readers in terms of their comprehension monitoring processes as indicated by their error-detection rates and false identification rates?

3b. Are there differences between skilled and less skilled sixth-grade readers in terms of their comprehension monitoring processes as indicated by their predictions of comprehension performance accuracy?

3c. What are the relationships between the process measures and comprehension performance, and what are the relationship among the process measures (e.g.,., online measure -- error-detection rates vs. off-line measure -- self-judgements of comprehension accuracy) employed in the error-detection task?

Research question 4 ***focuses on individual differences in the strategy dimension of comprehension monitoring and the nature of assessment techniques in this dimension.***

Two subquestions were developed:

4a. Are there differences between skilled and less skilled sixth-grade readers in terms of their comprehension monitoring strategies as indicated by their lookback behaviors during the error-detection task?

4b. What are the relationships between the lookback behaviors during error-detection performance and comprehension performance?

Research question 5 ***concerns individual differences in the attribution dimension of comprehension monitoring and the nature of assessment techniques in this dimension.***

Two subquestions were formulated:

5a. Are there differences between skilled and less skilled sixth-grade readers in terms of their motivational beliefs as indicated by their attributional causes for their success or failure of comprehension during the error detection task?

5b. What are the interrelationships among sixth-grader's general learning motives (as assessed by the LPQ), their perceived goals/motives of reading (as indicated by the goal/motive component scores in the interview and the questionnaire), and their attributional causes for their success or failure of comprehension during error detection task?

Research question 6 ***examines how reading comprehension performance relate to the various dimensions of comprehension monitoring.***

Two subquestions were formulated:

6a. Which component in comprehension monitoring has the most powerful influence on reading comprehension performance?

6b. What are the interrelations among the comprehension monitoring components?

6. DESIGN OF THE RESEARCH

This chapter describes the design of the research. A brief overview of the overall investigation and selection criteria of the study sample, and a description of the pilot study are included.

6.1 Overview of the Research

A within-grade ability group comparison design was chosen for the present research which comprised three studies.

Study 1 was constructed to tap the subjects' knowledge and goals/motives of comprehension monitoring. It was made up of a structured metacognitive interview and a similar questionnaire with individual participants. The interview consisted of 20 questions. The questionnaire consisted of the same questions but each question was supplied with several possible answers generated from the interview responses (details to be reported in chapter 7). This multiple-choice questionnaire was devised to reduce heavy verbalization demands and to verify the consistency of the responses.

Study 2 was designed to assess the subjects' approaches to learning and examine the relationship between learning motives and strategies in general, and motives and strategies of reading and comprehension monitoring in particular. In this study, the Learning Process Questionnaire (LPQ) was administered to the subjects in small groups. This questionnaire contains 36 questions about students' learning motives and strategies.

Study 3, in which an error-detection task was implemented, was designed to examine the subjects' comprehension monitoring processes and strategies, and their motivational beliefs (attributional styles) in the comprehension monitoring process. In this study, each subject was required to read expository texts, via a microcomputer, statement by statement, and underline "problems" or "mistakes" (details to follow in chapter 9) while reading, and answer multiple-choice questions after reading each passage. Also, each subject was asked to predict his/her own accuracy of comprehension answers. This was followed by an attribution assessment of the subjects' perceptions of the causes for specific success and failure outcomes of comprehension.

The focuses of the three studies of the research are summarized in Table 6-1.

Table 6-1 Overview of the Research

Study	task	component assessed
1	metacognitive interview and questionnaire	knowledge, goal/motive
2	LPQ questionnaire	goal/motive
3	error-detection task comprehension questions self-judgement of comprehension accuracy attributional questions	process (on-line), strategy comprehension process (off-line) attributional beliefs

The three studies were held with each selected student in the sequence as outlined in Table 6-1. The data were collected in a standardized procedure, with the presentation of certain tasks being counterbalanced in order of presentation within study where appropriate. Details follow in subsequent chapters.

6.2 Subjects

Sixth-grade readers were examined in this research. The reason for selection of this particular reader group was twofold. First, this group of readers was targeted because of their development as maturing readers at the outset of transition from elementary to junior high school. It is evident that assignment loads for sixth graders become heavier than those of earlier years while, at the same time, steady teacher guidance and monitoring of learning is gradually diminished. Self-directed monitoring of understanding becomes very important in sixth-graders' learning and studying as their daily encounters with school tasks requiring fairly independent judgment of how well understanding is proceeding. Furthermore, among elementary school students, sixth-graders are thought to fufill more ably the research tasks (i.e., metacognitive interview, reporting detected comprehension errors, etc.) which require a fairly high degree of verbal fluency.

The actual selection of subjects for the research involved several steps. First, the research request was approved by the Edmonton Separate School District. Then, a pool of potential subjects was identified on the basis of their reading achievement scores available from school records. It should be noted that reading achievement is annually assessed in the school district by means of the Canadian Test of Basic Skills (CTBS). Candidates for participation in the study were preselected on the basis of their performance on the reading comprehension subtest of the most recently administered CTBS. Children were identified as skilled readers if they scored at or above the 70th percentile, and as less-skilled readers if they scored at or below the 30th percentile of the CTBS reading comprehension subtest. To make sure that all participants were able to read the experimental passages in the study, any subject unable to achieve a grade equivalent of at least 4.0 on the CTBS vocabulary subtest was eliminated. From this pool of potential subjects, further study was made of their general intelligence level, school achievement and other relevant background information (e.g., age, sex or language background) as recorded in their school files. To provide some control for intellectual factors, only those who scored within the average range (90-115) on the nonverbal scale of the Lorge-Thorndike Intelligence Test (i.e., the intelligence test used by the school system), with verbal and nonverbal IQ to be within one standard deviation of each other, were included in the study.[1] In addition, consultation with school principals and teachers was made in order to exclude subjects with any serious sensory, physical or emotional anomalities. The classification of subjects as skilled or less skilled readers was further confirmed by the respective sixth-grade classroom teacher. Finally, letters were sent to parents or legal guardians of all students who were screened as acceptable for inclusion in the study to notify them of the purpose of the research. As well, parental permission for student participation in the study was sought and obtained.

The final selection consisted of 29 skilled readers and 30 less skilled readers. In view that the 59 subjects were from 13 schools located in different areas of Edmonton, with a minimum of three to a maximum of eight subjects in each school, the sample of students was considered adequately representative of the total school population with respect to socio-economic status. A summary of the sample characteristics is presented in Table 6-2. (Also see Appendix A for a stem and leaf displays of subject characteristics.)

Table 6-2 Sample Characterictics

Group	Sex			CA	Lorge-Thorndike IQ			CTBS (%ile)	
	M	F		(in months)	NVIQ	VIQ	FIQ	Comp.	Vocab.
Less Skilled	14	16	M	135.20	104.43	100.07	102.53	18.47	27.90
readers			SD	3.94	7.14	5.90	5.78	7.54	20.32
Skilled	14	15	M	138.00	106.37	110.00	108.45	84.00	79.14
readers			SD	3.14	7.16	5.27	5.30	6.92	12.87

---

[1] Since the verbal component of the Lorge-Thorndike Intelligence Test is highly related to reading proficiency, neither Verbal or Full scale quotients were considered appropriate for selection use (J. Lupart, 1981).

In a Hotelling T^2 analysis involving the above six subject variables (CA, NVIQ, VIQ, FIQ, Comp., Vocab.), there was no significant difference between the two groups in Chronological Age and Lorge-Thorndike Non-verbal IQ when these two subject characteristics were considered simultaneously with other subject variables.[2] When both CA and Non-verbal IQ were included with the other four variables, the Hotelling T^2 for CA was 9.067 giving an F-ratio of 1.379 and a probability of 0.241 (DF= 6/52) while for Lorge-Thorndike Non-verbal IQ the Hotelling $T^2 = 1.092$ giving an F-ratio of 0.166 and a probability of 0.985 for DF = 6/52. (See Appendix B for details of the Hotelling T^2 analysis.)

In summary, two groups of sixth-grade students, one group being less skilled readers and the other above average in reading, but both groups equated on chronological age and general ability as described above, constituted the study sample of the research.

6.3 Pilot Study

Prior to initiating the main research, a small pilot study, involving four skilled and four less-skilled sixth-grade readers similar to those in the selected sample, was conducted to evaluate a) the appropriateness of the interview questions, b) the suitability of the reading passages to be used in the error-detection task, and c) the adequacy of the research procedures.

Several changes were made based on the results of the pilot study. First, with respect to the metacognitive interview questions (see Appendix C), the question "What do you think reading is all about?" was originally devised to assess the reader's perceived goal of reading. However, it was found that such a question was vague and confusing for the majority of the pilot study subjects and did not yield much useful information. It was then replaced by an "incomplete" sentence "When I read, I try to ..." for the student to complete the statement. It was anticipated that the change of the question format would yield more specific information regarding the reader's perceived goal of reading.

For the reading materials, the pilot study subjects were asked to comment on the passages when they finished reading. Modifications based on their comments were incorporated into the passages used in the main study.

---

[2] As pointed out by Leong (1974), when considering subject characteristics, "the use of the multivariate Hotelling T^2 should be preferred over the univariae t test as the former provides for the conjoint comparison of linear combinations of relevant variables" (p. 198). There is a greater probability of committing Type I errors if a large number of separate t test ischosen (Tatsuoka, 1971, cited in Leong, 1974).

With regard to research procedures, the research design of the error-detection task was revised to include two experimental conditions to further examine the effects of general and specific instructions upon error detection.

6.4 Chapter Summary

This chapter provided an overview of the research. The focuses of the three separate but related studies on comprehension monitoring were outlined. Simply put, Study 1 examined the knowledge and goal/motive dimension of comprehension monitoring via a structured interview and a questionnaire in a parallel form. Study 2, utilizing the Learning Process Questionnaire, explored general learning motives and strategies in students and how these aspects could be related to the knowledge and goal/motive dimension of comprehension monitoring. The error-detection task, implemented in Study 3, was designed to investigate readers' comprehension monitoring processes and strategies, and their attributional styles in the comprehension monitoring process. In addition, the rationale for subject selection was explained and actual sampling procedures detailed. The chapter also included a note on the pilot study conducted prior to the main research.

The methods and results of the three studies will be reported in the subsequent three chapters.

7. STUDY 1: METACOGNITIVE INTERVIEW AND QUESTIONNAIRE

Study 1 was designed to examine the knowledge and goal/motive aspects of comprehension monitoring in sixth-grade readers. In this chapter, the method of this study is first presented, analyses of data are then reported and results discussed.

7.1 Method

A structured metacognitive interview and a similar questionnaire were employed in this study to examine students' metacognitive knowledge of reading and comprehension monitoring. The subjects, materials, experimental procedures and data scoring procedures are described as follows.

7.1.1 Subjects

Participants were the 59 selected subjects (30 less skilled and 29 skilled readers) as described in the previous chapter.

7.1.1 Materials

Interview. An interview schedule consisting of 20 open-ended questions adapted from previous studies (Garner & Kraus, 1981-1982; Kirby & Moore, 1987; Myers & Paris, 1978; Neyrinck, 1986, Paris & Jacobs, 1987) was developed to examine sixth-grade readers' metacognitive knowledge and perceived goals and motives of reading. Two criteria were employed in selecting the interview items. First, an attempt was made to select questions representing the goal/motive and knowledge components in the model as established in Chapter 2. Second, findings of the previous studies were taken into consideration; questions that were ambiguous or had shown no interesting developmental/ability differences were excluded (Kirby & Moore, 1987). Specifically, the interview items are divided into two components. Component one consists of five questions constructed to tap the goal/motive component of comprehension monitoring. Component two consists of 15 questions designed to tap the knowledge component of comprehension monitoring and further divided into three categories: person, task/text, and strategy. Each category contains five questions. It should be noted that certain items focus on the reader's perception and motives of reading in general and may not directly tap knowledge of comprehension monitoring per se. It is believed, however, that such perception and motives have crucial influence on the reader's comprehension monitoring mechanisms and are therefore included for investigation. Following Forrest-Pressley &

Waller's (1984) suggestion, the interview questions are organized in a sequence involving a natural progression to elicit the reader's responses (see Appendix C).

The table below illustrates the composition, code, and source of the interview questions.

Table 7-1 Composition of interview questions

component	category	code	question	source
goal/motive		like reading	1. What do you like about reading? Why?	Neyrinck (1986)
		dislike reading	2. What, if anything, do you dislike about reading? Why?	Neyrinck (1986)
		self good reader	3. Are there times when you think of yourself as a "good" reader? Explain.	Neyrinck (1986)
		self poor reader	4. Are there times when you think of yourself as a "poor" reader? Explain	Neyrinck (1986)
		reading goal	5. When I read, I try to ...	
knowledge	person	better reader	6. What would help you become a better reader?	Paris & Jacobs (1987)
		age	7. Do you think children your age read as well as adults? Why?	Kirby & Moore (1987)
		wealth	8. Suppose there were two boys named John and Alan who came from different homes. John's parents were rich and John had lots of toys and books. Alan's parents were poor and didn't have many books at home. Do you think one of these boys was a better	Myers & Paris (1978)

				reader at school? Which one? Why?	
		arithmetic	9.	The other day I talked to a boy/girl who was really good at arithmetic. Do you think he/she was also a good reader? Why?	Myers & Paris (1978)
		good reader	10.	What makes someone a really good reader?	Myers & Paris (1978)
knowledge	text/task	first sentence	11.	What does the first sentence usually do for a paragraph or story ?	Myers & Paris (1978)
		last sentence	12.	What does the last sentence do (for a story or a paragraph)?	Myers & Paris (1978)
		length	13.	I asked a girl named Joan to read a story that was five pages long, and a girl named Mary to read a story that was two pages long. Which girl took longer to read her story? Why?	Myers & Paris (1978)
		skim	14.	If I asked you to read a story/passage really fast and you could only read some sentences, which ones would you try to read? Why?	Paris & Jacobs (1987)
		task difficulty	15.	What makes something difficult to read?	Garner & Kraus (1981-1982)
		difficult word	16.	When you're reading, what do you do if there's a word you don't understand?	Myers & Paris (1978)

knowledge	strategy	difficult sentence	17. What do you do if you don't understand a whole sentence?	Myers & Paris (1978)
		evaluation	18. When you read a story, how can you know you're reading it well?	Garner & Kraus (1981-1982)
		image	19. When you're reading, do you ever make up pictures in your head? Why?	Kirby & Moore (1987)
		rereading	20. Do you ever have to go back and read things over? Why?	Paris & Jacobs (1987)

Questionnaire A questionnaire consisting of the same questions of the interview was used. Nevertheless, the questionnaire was different from the interview in two aspects. First, the interview questions were open-ended. In contrast, the questionnaire questions were supplied with several possible answers generated from the first part of the interview results. Second, whereas the interview questions were presented in a fixed order involving a natural progression, the questionnaire questions were presented in a random order with all category items being mixed up (see Appendix D). The questionnaire was developed after the first phase of the study had been conducted (see procedure section for details). This multiple-choice questionnaire was devised to reduce heavy verbalization demands and to verify the consistency of the responses within each subject.

7.1.2 Procedure

To prevent potential biasing and carry-over effects between the interview and the questionnaire responses, the interview and the questionnaire were given three weeks apart and in a counter-balanced order, with the subjects being randomly assigned for their first testing to either the interview or questionnaire condition. Accordingly, four phases of task administration were involved in this study. In phase I, half of the subjects randomly selected from the skilled-reader group (A) and the less-skilled-reader group (B) were individually interviewed. Their responses were used to generate possible answers for each question of the questionnaire. Based on these answers, a multiple-choice questionnaire was developed and it was given to another half of the subjects (who were not interviewed before) from the skilled-reader group (C) and the less-skilled-reader group (D) on a small group basis. This constituted the second phase of the research session. In phase III, three weeks apart from phase one, the questionnaire was administered to the subjects (groups A & B) who were interviewed in phase I. Finally, in phase IV, three weeks apart from phase two, the subjects (groups C & D) who were given the questionnaire before were individually interviewed. Table 7-2 depicts the administration sequence of this study.

Table 7-2 Administration Sequence of Study 1

Phase	task	skilled reader group	less-skilled reader group	time line
I	interview	A (14 subjects)	B (15 subjects)	week 1
II	questionnaire	C (15 subjects)	D (15 subjects)	week 3
III	questionnaire	A	B	week 4
IV	interview	C	D	week 6

With respect to the interview condition, subjects were interviewed individually in a quiet room at school. The subject sat opposite to the tester, with a small table between them. A tape recorder was placed on the table. Before the interview, the tester briefly established rapport with the subject and explained the nature of the interview. The subject was told that the purpose of the interview was to know what he/she thought about reading and himself/herself as a reader. It was emphasized that there were no "right" or "wrong" answers to the questions. His/her answers were confidential and therefore he/she did not have to worry about what his/her teachers or anyone else might want him/her to say. The questions were given in the same order for all participants because it was felt that the questions involved a natural progression. If a subject was unable to answer or understand a particular question, it would be repeated. If the repetition failed to elicit a response, the question would be rephrased until an answer was produced. Also, if a subject gave a very brief response, the tester would ask for elaboration because it was presumed that elaborative comments might be more informative about subject perceptions of reading. However, probing was used in a very careful manner to avoid forcing subjects to use inferential processes to answer questions. The entire session was taped recorded. It required about 20 to 30 minutes with each subject.

Similar procedures applied to the administration of the questionnaire except that the tape recorder was not used. In a small group setting, the subjects (two to three at one time) were given the questionnaire and asked to choose the answer that best described their thoughts and feelings about reading. It was emphasized that there were no "right" or "wrong" answers to the questions. The questionnaire items were preceded by two practice items. To minimize problems caused by reading difficulties, the tester read each question and its possible answers as the group went through the questionnaire. Any question about the meaning of an item was dealt with as non-directively as possible. It took about 15 minutes for students to finish the questionnaire.

7.1.3 Scoring

For the interview items, attempts were made to establish a scoring system. First, each subject's responses were transcribed into a written account from the audio-tapes.[1] Next, following Kirby and Moore's (1987; Moore, 1983) scoring system, categories of responses were established for each interview item using an ordinal scale of 0, 1, 2, 3, and 4. Zero (0) was assigned for "don't know" or irrelevant responses. One(1) point was given to responses that focused on general or mechanical aspects of reading comprehension. Two (2) points were given to responses with one relevant, but not the most critical, explanation or strategy of reading. Three (3) points were credited for responses reflecting increasing appreciation of reading goals, text structure or strategies. Four (4) points were assigned for answers that include most important aspects of effective reading comprehension. The following example illustrates the scale (see Appendix E for details).

Table 7-3 Example of the scoring scale

Question	10. What does the first sentence usually do for a story?	
Score	Response	Scoring scheme
0	It starts with a capital letter.	irrelevant
1	It begins with "Once upon a time".	surface feature
2	It tells what happens first.	one concrete aspect, doesn't show awareness of general text structure
3	It describes the people, setting, etc. of the story.	more than one concrete aspect, shows awareness of general text structure
4	It tells what the story will be about.	abstract aspect, shows understanding of most important aspect(s) of text structure.

---

[1] No attempts were made to shorten the responses into summary statements because it was believed that a full written account reflects the respondent's overall thinking pattern. If multiple answers were given, the scorer was asked to give a score to the most relevant answer.

It can be seen from the above example that the scoring scale is ordinal in nature because higher scores reveal more metacognitive knowledge. Kirby and Moore (1987) argued that the ordinal scales used in their interview study also approximate interval scales like those produced by common attitude measures and are therefore suitable for the calculation of means, standard deviations, and correlations. Following Kirby and Moore's argument and in view of the considerable gain of convenience (i.e., it is easier to see both general and specific trends in the data), the scoring scales used in the present study were treated as suitable for descriptive statistics. Further, parametric tests were done with caution if distributional peculiarities arose.

To determine the reliability of the scoring procedure, an independent scorer with no information about skill levels of the subjects was asked to score a subset of 22 interview protocols (half of skilled and half of less skilled readers) randomly selected from the total sample of 59 students. Inter-rater reliability was sought using the formula suggested by Miles and Huberman (1984, p. 64):

$$\text{reliability} = \frac{\text{number of agreements}}{\text{total number of agreements plus disagreements}}$$

The proportion of agreement between the researcher and the independent scorer was .93 according to the established scoring scheme. Thus, the inter-rater reliability coefficient was above the acceptable level (90%) of inter-coder agreement recommended by Miles and Huberman (1984).

Since the questionnaire answers were generated from the interview responses, the scoring system established for the interview items also applied to the questionnaire items. (See Appendix F for scoring key.)

7.2. Results and Discussion

Differences between skilled and less skilled readers in responding to questions reflecting metacognitive reading awareness and the influence of using two different measuring techniques (i.e., interview vs. questionnaire) were the central issues of this study. To compare reader group differences and interview/questionnaire differences, the data were analyzed in four aspects: (1) overall performance , (2) component, (3) category, and (4) item performance. Basically, the data were subjected to 2 (reader group) x 2 (measuring method) analyses of variance with repeated measures on the last factor. For the first factor, skilled readers and less-skilled readers were the levels. For the second factor, interview and questionnaire were the trials. In short, the independent variables were reader group and measuring method, and the dependent variables were overall performance scores, component scores, category scores, and item scores. In addition, reliability between the two measuring methods was also examined.

Before major analyses were performed preliminary analyses were carried out to determine the effect of task order on subjects' interview and questionnaire responses.

7.2.1 Preliminary Analyses

Although attempts were made to prevent potential carry-over effects between the interview and the questionnaire responses by having the interview and the questionnaire given three weeks apart and in a counter-balanced order, the effectiveness of these preventive procedures were examined using two separate 2 (reader group) x 2 (task order) analyses of variance, one for the interview data and one for the questionnaire data.

For the interview data, a highly significant main effect for reader group was observed [$F(1,58)=61.036$, $p \leq .0001$]. The main effect for reader group revealed that skilled readers scored significantly higher than less skilled readers in responding to the interview questions. The mean interview scores for skilled and less skilled readers were 3.10 and 2.43 respectively. Contrary to expectation, the main effect for interview order was also significant [$F(1,58)=13.759$, $p \leq .001$], indicating that both groups of readers scored significantly higher if they were interviewed on the second occasion (i.e., questionnaire as the first task and interview as the second task). For those who were interviewed in the first occasion, the mean score was 2.59, and for those who had the interview in the second occasion, the mean score was 2.92. The reader group by interview order interaction was not significant [$F(1,58) =.781$, $p =.381$). (See Appendix G for the ANOVA result, and the means and standard deviations of the interview mean scores for the subjects by reader group and interview order.)

With regard to the questionnaire data, there was a highly significant main effect for reader ability [$F(1,58)=13.338$, $p \leq .001$], indicating a pattern similar to that of the interview data, that skilled readers' scores of metacognitive reading awareness were significantly higher than those of less skilled readers. The mean questionnaire scores for skilled and less skilled readers were 2.98 and 2.54 respectively. On the other hand, the main effect for questionnaire order and the interaction effect were not significant. That is, similar differences for skilled and less skilled readers were observed no matter whether the questionnaire was given as the first or second task. (See Appendix H for the ANOVA result, and the means and standard deviations of the questionnaire mean scores for the subjects by reader group and questionnaire order.)

Integrating the results of the two ANOVAs, it can be seen that the main effect for reader group was highly significant in both analyses. On the other hand, the main effect for interview order was somewhat unexpected. It is speculated that this particular pattern of results may be more related to the interactive nature of the interview procedure rather than to the carry-over effect of the first task upon the second task. Since an open-ended metacognitive interview requires the interviewee to verbalize his/her views and feelings, it seems natural that one would be more "open" if he/she had more time to be acquainted with the tester/interviewer. Having the questionnaire on the first occasion and therefore having a chance to get familiar with the tester, the subjects who were interviewed on the second occasion might feel more comfortable with the tester and spontaneously provide more information. The non-significant main effect for questionnaire order seems to be consistent with this line of reasoning. The questionnaire procedure does not require respondents to directly interact with the tester in order to answer the questions; familiarity with the tester may not cause a significant impact upon respondent behavior. Furthermore, it should be noted that the interaction effect in both analyses was not significant, indicating the significant difference between the two groups observed in both sets of data was not due to differential reactions to different task orders. In view of the overall pattern of results, it is argued that the effect of task order, though significant in the interview condition, is not a major factor contributing to the observed reader group differences and will not be further pursued in subsequent analyses. In the following sections, results and discussions will focus on comparing reader group differences and interview/questionnaire differences.

7.2.2 Overall Performance

An overall performance score of metacognitive reading awareness was computed by averaging the 20 item scores for each subject. A 2 (reader group) x 2 (measuring method) analysis of variance with repeated measures on the last factor was performed using the overall performance scores. Table 7-4 shows the means and standard deviations of the overall performance scores for each reader group for the interview method and the questionnaire technique. The means are graphically illustrated in Figure 7-1.

A highly significant main effect was found for the reader group [$F(1,57)=60.787$, $p \leq .00001$], with mean performance scores of 3.04 and 2.48 for skilled and less skilled readers respectively, indicating that skilled readers demonstrated overall greater metacognitive reading awareness in both measuring methods. The main effect of measuring method was not significant. The group by method interaction effect was significant at the .05 level [$F(1,57)=5.078.$, $p \leq .028$], indicating that skilled readers appeared to obtain better scores in the interview condition than in the questionnaire condition while less skilled readers tended to produce higher scores in the questionnaire condition than under the interview condition. To clarify the interaction, comparisons of the means involved in this interaction were made using the Tukey Honestly Significant Difference (HSD) procedure. Results showed that differences between the two reader groups were significant for both interview and questionnaire methods (Tukey's HSD = 0.23, $p < .05$).

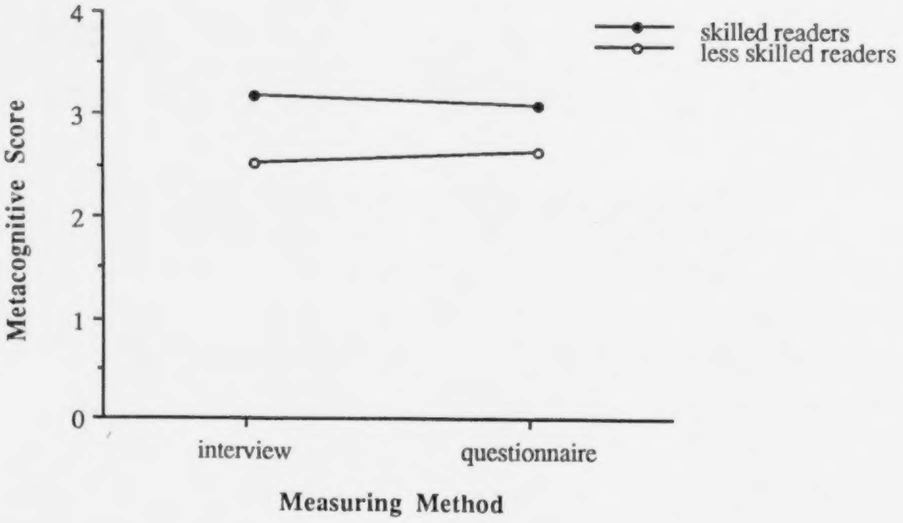
Table 7-4

Means (M) and Standard Deviations (SD) of Overall Performance Scores for Skilled and Less Skilled Readers

Reader Group		Measuring Method Interview	Questionnaire
Skilled	M	3.10	2.98
Readers (N = 29)	SD	0.31	0.27
Less Skilled	M	2.43	2.54
Readers (N = 30)	SD	0.41	0.36

Figure 7-1

Overall Performance of Skilled and Less Skilled Readers



7.2.3 Goal/Motive Component

Five questions of the interview/questionnaire items were designed to measure the goal/motive dimension of reading comprehension and monitoring. A mean score for this component was computed for each subject by averaging the five goal/motive item scores. The means and standard deviations of the goal/motive component and of its items for skilled and less skilled readers in two measuring methods are presented in Table 7-5. The means of the goal/motive component are graphically depicted in Figure 7-2.

Figure 7-2

Performance on the Goal/Motive Component

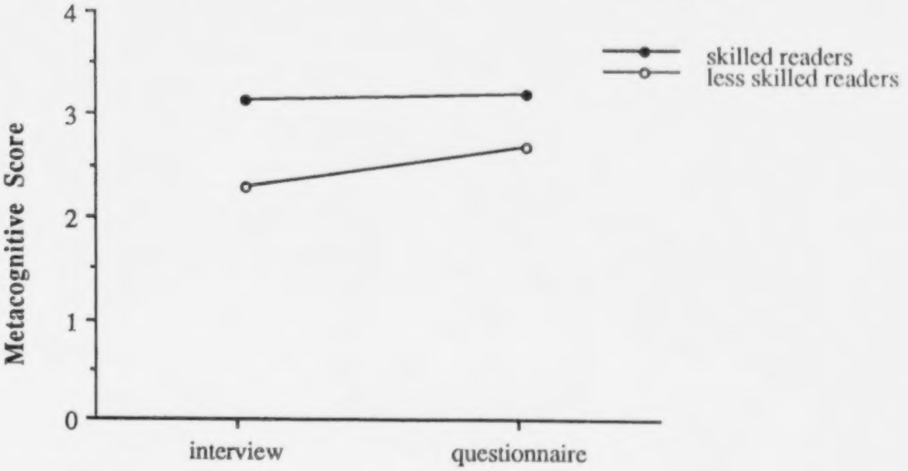


Table 7-5

Means (M) and Standard Deviations (SD) of Mean Scores for Goal/Motive Component and Its Five Items for Skilled and Less Skilled Readers

Reader Group		Skilled Readers		Less Skilled Readers	
Measuring Method		Interview	Questionnaire	Interview	Questionnaire
Component:					
Goal/Motive	M	3.06	3.12	2.21	2.59
	SD	0.55	0.51	0.72	0.61
Items:					
Like Reading	M	3.41	3.03	3.20	2.77
	SD	0.50	0.82	0.81	0.82
Dislike Reading	M	3.35	3.35	1.90	2.50
	SD	0.32	0.31	0.39	0.38
Self Good Reader	M	2.76	3.10	2.00	2.87
	SD	1.30	1.01	1.39	1.31
Self Poor Reader	M	2.62	2.76	1.53	2.40
	SD	1.27	1.09	1.07	1.52
Reading Goal	M	3.14	3.38	2.43	2.43
	SD	0.99	0.68	1.31	1.41

Separate repeated measures ANOVAs were conducted on the goal/motive component and its five items using mean scores as dependent measures. The results are reported in Table 7-6.

Table 7-6
F Values and Probabilities from ANOVAs
for Goal/Motive Component and Its Five Items

	Effect (DF = 1, 57)		
	Group	Method	Group x Method
Component: Goal/Motive	36.077***	4.407*	2.115
Items: Like Reading	3.138	8.383**	0.036
Dislike Reading	33.532***	2.721	2.721
Self Good Reader	4.025	7.907**	1.467
Self Poor Reader	11.509***	4.140	2.178
Reading Goal	14.074***	0.373	0.373

$*p \leq .05$ $**p \leq .01$ $***p \leq .001$

For the goal/motive component, the significant main effect of reader group [F(1,57)=36.077 and $p \leq .00001$] indicated that skilled readers displayed clearer goal orientation and greater interest towards reading. The mean goal/motive scores for skilled and less skilled readers were 3.09 and 2.40 respectively. The main effect for measuring method was significant at the .05 level [F(1,57)=4.407., $p \leq .04$]. It was noted that skilled readers and particularly less skilled readers obtained better goal/motive scores when the questionnaire method was used. The group by method interaction was not significant.

With respect to the five individual items within the goal/motive component, no significant group by method interaction effect was obtained. There was a main effect of measuring method for the question "What do you like about reading?" (Like Reading) [F(1,57)=8.383, $p \leq .005$], indicating that both groups of readers were more able to verbalize their enjoyment about reading in the interview condition. In contrast, the main effect of measuring method obtained for the question "Are there times when you think of yourself as a good reader?" (Self Good Reader) [F(1,57)=7.907, $p \leq .007$] revealed a totally different pattern: both groups, and particularly less skilled readers, were able to select more appropriate answers when a number of alternatives were provided in the questionnaire condition. The format of responding may have particular effects upon subjects' reporting of feelings towards reading. It is speculated that less skilled readers, for instance, were not used to having a self image of being a good reader and therefore not able to retrieve relevant information when the question was presented to them during the interview. On the other hand, when examples of being a good reader were provided to them in the questionnaire, they were able to relate personal experience to the examples and therefore select a more appropriate answer. The issue of response method will be further discussed in the general discussion section.

In terms of group differences, a main effect of reader group was observed for three items: "What do you dislike about reading?" (Dislike Reading) [F(1,57) = 33.532, $p \leq .00001$], "Are there times when you think of yourself as a poor reader?" (Self Poor Reader) [F(1,57) = 11.509, $p \leq .001$], and " When I read, I try to ... " (Reading Goal) [F(1,57) = 14.074, $p \leq .001$]. Additional item analyses were conducted to determine whether similar results of group differences would emerge. However, when frequency counts of each response scale (i.e., 0, 1, 2, 3, 4) were used as dependent measures, the chi-square statistic was considered inappropriate because of low frequencies (i.e., frequencies less than five) in certain cells (e.g., for the 0 or 1 scoring scale). As a result, item analysis was not pursued.

Further analyses into the patterns of responses revealed specific differences between skilled readers and less skilled readers. For the questions Dislike Reading and Reading Goal, skilled readers tended to view reading as meaning extracting and enjoy reading most of the time (e.g., I don't like reading stories that don't make sense; I try to understand the story). Less skilled readers, however, appeared to view reading as decoding (e.g., I don't like reading aloud, I try to get all the words right) or judge reading solely on the basis of pleasure (e.g., I don't like reading stories that make me upset). For the question Self Poor Reader, less skilled readers seemed to have a poor self image (e.g., I'm a poor reader because I read choppy) and again maintained a decoding orientation towards reading (e.g., I feel I'm a poor reader when there are big words that I don't know). In contrast, skilled readers exhibited higher self confidence (e.g., I'm always a good reader) and considered story difficulty or lack of effort major reasons for poor reading performance. On the whole, analyses of the results of individual items under the goal/motive component reflected that skilled and less skilled readers were different in terms of their perceived goals of reading and had different motives when they engaged in reading activities.

7.2.4 Knowledge Component

The knowledge component of the interview/questionnaire items consisted of 15 questions designed to measure the reader's knowledge of person, task, and strategy variables in reading. The results of the overall knowledge component will be discussed first, followed by sections on findings of the person, task and strategy categories.

A mean score for the knowledge component was computed for each subject by averaging the 15 knowledge item scores. The results of the repeated measures ANOVA revealed no significant effects with respect to measuring method and group x method interaction. The significant main effect for reader group [F(1,57) = 47.399, p $\leq$.00001] suggested that skilled readers displayed greater metacognitive knowledge about reading comprehension and monitoring than less skilled readers. The mean knowledge scores for skilled and less skilled readers were 3.02 and 2.51 respectively.

While skilled and less skilled readers displayed overall metacognitive knowledge differences, further analyses into person, task, and strategy categories revealed some specific patterns of results.

7.2.5 Person Category

Within the knowledge component, there were five questions designed to measure subjects' metacognitive knowledge about how personal characteristics or individual differences affect reading behavior. A mean score for this person category was computed for each subject by averaging the five item scores under this category. The means and standard deviations of the person category and of its items for skilled and less skilled readers in two response methods are presented in Table 7-7. The means of the person category scores are graphically displayed in Figure 7-3.

Separate repeated measures ANOVAs were conducted on the person category and its five items using mean scores as dependent measures. The results are reported in Table 7-8. For the person category, the main effect of measuring method and the group by method interaction effect were not significant. The main effect of reader group was significant at the .05 level [F(1,57)=6.727 and p $\leq$.012]. The mean person scores for skilled and less skilled readers were 2.97 and 2.7 respectively. Although on average skilled readers scored slightly higher than less skilled readers, results of the ANOVAs for the five individual items and further item analyses seemed to indicate that both groups demonstrated similar understanding of how individual differences affect reading proficiency.

Figure 7-3

Performance on the Person Category

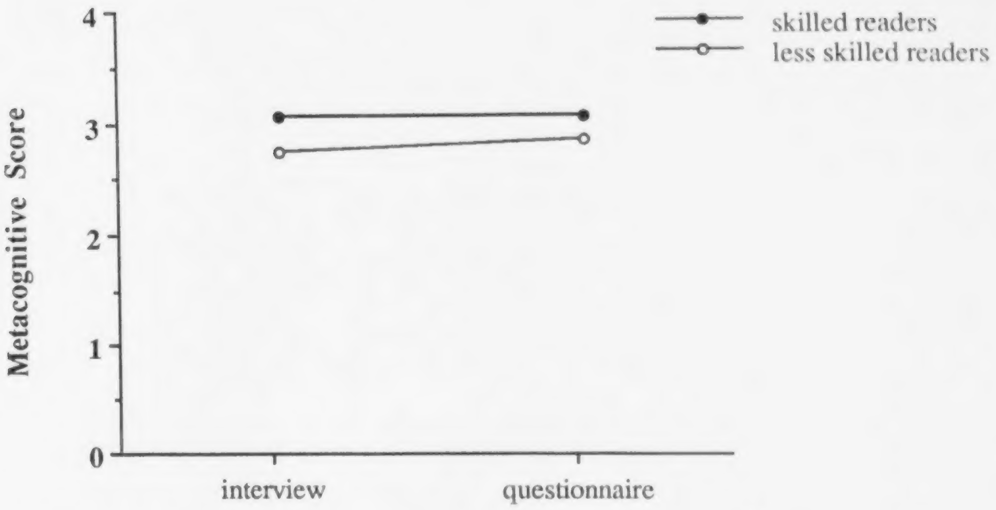


Table 7-7

Means (M) and Standard Deviations (SD) of Mean Scores for Person Category and Its Five Items for Skilled and Less Skilled Readers

Reader Group		Skilled Readers		Less Skilled Readers	
Measuring Method		Interview	Questionnaire	Interview	Questionnaire
Category:					
Person	M	2.97	2.97	2.65	2.75
	SD	0.41	0.43	0.54	0.58
Items:					
Better Reader	M	2.83	2.93	2.73	3.10
	SD	0.71	1.00	0.83	0.66
Age	M	3.38	2.97	2.67	2.67
	SD	0.82	1.38	1.54	1.32
Wealth	M	2.86	3.48	2.53	2.87
	SD	0.69	0.74	0.68	1.11
Arithmetic	M	2.76	2.55	2.17	2.57
	SD	0.99	1.21	1.29	1.22
Good Reader	M	3.00	2.93	3.13	2.57
	SD	0.54	0.92	0.43	1.10

For the five individual items within the person category, no significant group by method interaction effect was obtained. The only significant main effect of reader group was observed for the question about a rich boy and a poor boy and who would be a better reader (Wealth) [F(1,57)=8.003, $p \leq .006$]. Skilled readers seemed to be more aware that wealth does not necessarily imply better reading ability. It should be noted that the main effect of measuring method was also significant for this question [F(1,57)=12.44, $p \leq .001$], indicating that both groups of readers were able to select better answers in the questionnaire condition (i.e., able to take factors other than wealth into consideration when these factors are provided in the multiple choice format).

Table 7-8
F Values and Probabilities from ANOVAs
for Person Category and Its Five Items

	Effect (DF = 1, 57)		
	Group	Method	Group x Method
Category:			
Person	6.727*	0.559	0.432
Items:			
Better Reader	0.064	2.455	0.770
Age	3.996	0.862	0.861
Wealth	8.003**	12.440***	1.129
Arithmetic	1.572	0.221	2.181
Good Reader	0.509	5.933	3.639

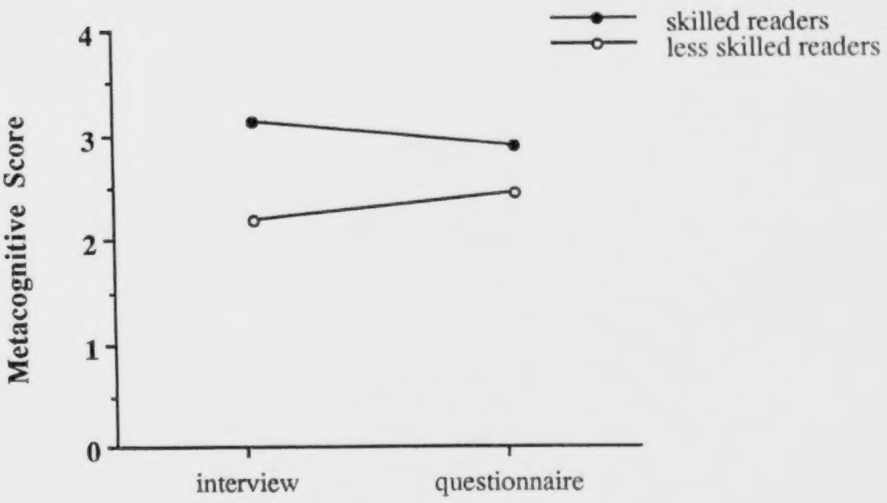
*$p \leq .05$ **$p \leq .01$ ***$p \leq .001$

7.2.5 Task Category

Five questions within the knowledge component were designed to measure readers' awareness of task/text variables that affect reading. A mean score for this category was computed for each subject by averaging the five task item scores. Table 7-9 displays the means and standard deviations of the task category and of its items for skilled and less skilled readers in two response methods. The means of the task category scores are illustrated in Figure 7-4.

Figure 7-4

Performance on the Task Category



Separate repeated measures ANOVAs were performed on the task category and its five items using mean scores as dependent measures. Table 7-11 presents the ANOVA results. For the task category, the main effect of measuring method was not significant. The significant main effect of reader group [F(1,57)=30.297 and p $\leq$.00001] indicated that skilled readers were more aware of characteristics of text structures and various task demands. The mean task scores for skilled and less skilled readers were 2.92 and 2.23 respectively. While the main effect for reader group was highly significant, it should be interpreted in view of the significant group by method interaction effect [F(1,57)=7.537, p $\leq$.008]. It was found that skilled readers were more able to verbalize their knowledge about text structures and the relationship between task demands and corresponding reading strategies. Less skilled readers, although they not displaying verbalized knowledge of task and text characteristics at a level similar to that of skilled readers, were able to select more appropriate answers when a number of alternatives were provided. To determine specific differences, comparisons were made between the task category mean scores of the two reader groups using the Tukey HSD procedure. Results showed that task score differences between the two reader groups were significant (Tukey's HSD = 0.41, p <.05) for both interview and questionnaire methods. Whereas skilled and less skilled readers showed smaller difference in terms of questionnaire mean scores (mean difference = 0.43), a marked difference (mean difference = 0.94) was found between the two groups for interview mean scores.

Results of the ANOVAs for individual items within the task category indicated a main effect of reader group in four of the five items. Except for the question regarding task difficulty, significant group differences were observed in terms of knowledge about characteristics of the first sentence (First Sentence) [$F(1,57) = 8.969$ and $p \leq .004$] and the last sentence (Last Sentence) [$F(1,57) = 14.885$ and $p \leq .001$] in a text, factors other than text length that affect reading time (Length) [$F(1,57) = 18.638$ and $p \leq .001$], and the use of skimming for a fast reading task (Skim) [$F(1,57) = 10.864$ and $p \leq .002$] . However, it should be noted that for the question Last Sentence, a significant group by method interaction [$F(1,57) = 7.823$ and $p \leq .007$] was also obtained. Further comparisons using the Tukey HSD test revealed that for this particular item the difference between the two groups was significant for the interview scores (Tukey's HSD = 0.62, $p < .05$) but not for the questionnaire scores. The only significant main effect for measuring method was obtained for the question First Sentence [$F(1,57) = 4.994$ and $p \leq .029$]; both groups scored higher in the interview condition.

A further look into the patterns of responses revealed some specific differences between skilled readers and less skilled readers. For the questions concerning text structure, skilled readers appeared to view the first sentence as a topic sentence and the last as a concluding statement. Less skilled readers, however, exhibited limited awareness about the particular functions of these sentences (e.g., first sentence tells what happens first and last sentence tells what happens last). For the questions regarding task demand, skilled readers seemed to be able to take more than one factor (e.g., passage length, background knowledge, specific set up of the passage, and reader's reading ability etc.) into consideration when they were asked to judge a person's reading time or a reading task's difficulty. In contrast, less skilled readers tended to evaluate reading task demand solely on the information provided (e.g., length of the passage determines reading time). It should be noted, however, that, although skilled readers reported more use of the skimming strategy, most of them did not use skimming in response to text structure (e.g., they chose to read the hard sentences or the ones with important information without specifying which part or parts of the text would usually contain such information).

Table 7-9

Means (M) and Standard Deviations (SD) of Mean Scores for Task Category and Its Five Items for Skilled and Less Skilled Readers

Reader Group		Skilled Readers		Less Skilled Readers	
Measuring Method		Interview	Questionnaire	Interview	Questionnaire
Category:					
Task	M	3.05	2.79	2.11	2.35
	SD	0.46	0.50	0.66	0.73
Items:					
First Sentence	M	3.59	3.31	2.93	2.60
	SD	0.57	0.60	1.29	1.33
Last Sentence	M	3.10	2.90	1.97	2.57
	SD	1.08	0.90	0.81	0.86
Length	M	3.14	3.28	1.90	2.33
	SD	1.36	1.03	1.32	1.32
Skim	M	2.72	2.10	1.53	1.67
	SD	1.25	1.47	1.25	1.40
Task Difficulty	M	2.69	2.35	2.20	2.60
	SD	0.89	1.40	0.96	1.45

Table 7-10

F Values and Probabilities from ANOVAs for Task Category and Its Five Items

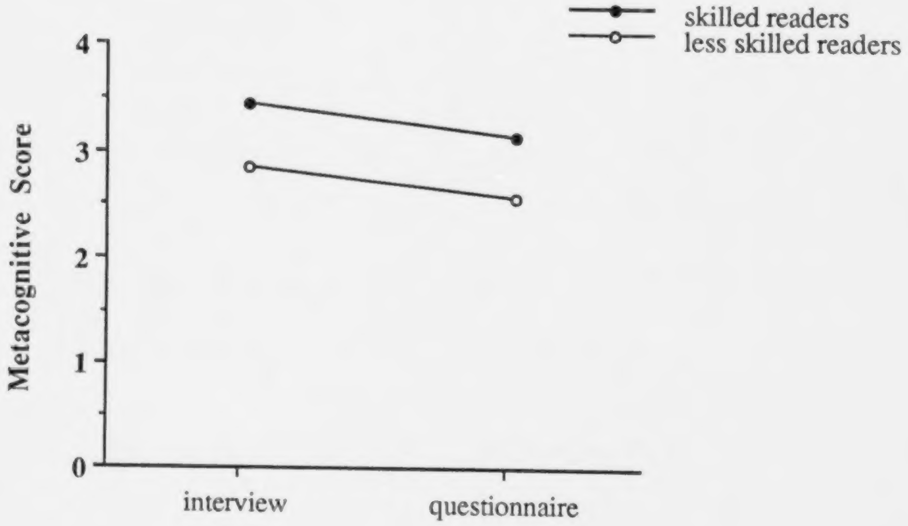
	Effect (DF = 1, 57)		
	Group	Method	Group x Method
Category:			
Task	30.297***	0.007	7.537**
Items:			
First Sentence	8.969**	4.994*	0.045
Last Sentence	14.885***	1.856	7.823**
Length	18.638***	1.819	0.486
Skim	10.864**	0.958	2.294
Task Difficulty	0.246	0.018	3.290

$*p \leq .05$ $**p \leq .01$ $***p \leq .001$

7.2.6 Strategy Category

The final category within the knowledge component consisted of five questions designed to measure subjects' metacognitive knowledge of various reading strategies. A mean score for this category was computed for each subject by averaging the five strategy item scores. The means and standard deviations of the strategy category and of its five items for skilled and less skilled readers in two response methods are presented in Table 7-11. The means of the strategy category are graphically depicted in Figure 7-5.

Figure 7-5
Performance on the Strategy Category



Separate repeated measures ANOVAs were conducted on the strategy category and its five items using mean scores as dependent measures. The results are reported in Table 7-12. For the strategy category, the main effect of reader group was highly significant [F(1,57)=23.596 and p ≤.00001], indicating that skilled readers demonstrated greater metacognitive awareness of the use of various reading strategies to solve reading problems. The mean strategy scores for skilled and less skilled readers were 3.19 and 2.6 respectively. The main effect of measuring method was also significant[F(1,57)=13.828 and p ≤.0005]; both groups scored better when the interview method was used. A further look into their interview answers reflected that they tended to respond with combined strategies and therefore were given higher scores if one of these strategies revealed greater metacognitive awareness. In contrast, they were only allowed to choose one best strategy from all of the alternatives when they responded to the questionnaire; the format of responding may have particular effect upon their reporting of reading strategies.

Table 7-11

Means (M) and Standard Deviations (SD) of Mean Scores for Strategy Category and Its Five Items for Skilled and Less Skilled Readers

Reader Group		Skilled Readers		Less Skilled Readers	
Measuring Method		Interview	Questionnaire	Interview	Questionnaire
Category:					
Strategy	M	3.35	3.03	2.74	2.47
	SD	0.54	0.60	0.55	0.52
Items:					
Difficult word	M	3.28	3.14	2.37	2.03
	SD	0.75	1.09	0.81	1.13
Difficult sentence	M	2.76	2.59	2.00	1.90
	SD	1.21	1.02	1.20	0.85
Evaluation	M	3.24	3.24	2.47	2.27
	SD	1.24	1.12	1.41	1.60
Image	M	3.66	3.07	3.47	3.13
	SD	0.67	0.75	0.94	1.04
Rereading	M	3.79	3.10	3.40	3.00
	SD	0.41	1.45	1.13	1.34

For the five individual items within the strategy category, no significant group by method interaction effect was observed. Significant group effects were obtained for the questions regarding what strategies to be used to solve a word problem (Difficult Word) [F(1,57)=21.01, $p \leq .0001$] or a sentence problem (Difficult Sentence) [F(1,57)=13.167, $p \leq .001$]; skilled readers demonstrated greater awareness of the use of relevant strategies to solve these problems. Skilled readers also scored significantly higher than less skilled readers in terms of how to evaluate their level of understanding while reading (Evaluation) [F(1,57)=9.631, $p \leq .003$]. Significant method effects were observed for the questions regarding the use of imagery strategy (Image) [F(1,57)=9.643, $p \leq .003$] and rereading strategy (Rereading) [F(1,57)=6.959, $p \leq .011$]; both groups scored significantly higher in the interview condition.

Further examination of the patterns of responses revealed some unique differences between skilled and less skilled readers. Skilled readers reported the use of context to solve reading obstacles in the reading process. They also indicated that they would adopt the semantic standard to evaluate their level of comprehension. In contrast, less skilled readers tended to rely on decoding to solve reading problems or to monitor their comprehension. It should be noted, however, that both groups reported the use of imagery and rereading to aid reading comprehension.

Table 7-12
F Values and Probabilities from ANOVAs
for Strategy Category and Its Five Items

	Effect (DF = 1, 57)		
	Group	Method	Group x Method
Category: Strategy	23.596***	13.827***	0.077
Items: Difficult word	21.010***	3.879	0.667
Difficult sentence	13.167***	0.470	0.033
Evaluation	9.631**	0.220	0.220
Image	0.134	9.643**	0.729
Rereading	1.280	6.959*	0.492

*$p \leq .05$ **$p \leq .01$ ***$p \leq .001$

7.2.7 Interview and Questionnaire Comparisons

As indicated in the above analyses, the interview technique and the questionnaire method obtained comparable results for both skilled and less skilled readers. To examine the degree of consistency of the responses to the two measuring techniques, scores from the two measures were correlated. A reliability coefficient (Cronbach's Alpha) of .81 was obtained for the two instruments. Reliability coefficients for the four variables ranged from moderate (.63 for task, .62 for goal/motive and strategy) to somewhat low (.45 for the person category); however, these reliability coefficients should be interpreted in view of the limited number of items (only five) in each category. Overall, the reliability between the two measures appears to be acceptable.

Correlational analyses offered another view of the relationships among standardized reading achievement scores and interview and questionnaire scores. Subjects' CTBS comprehension scores correlated more highly with interview sum scores ($r=.68$) than with questionnaire sum scores ($r=.57$), but both correlations were significant ($p < .01$). The correlation between interview and questionnaire scores was .56. Furthermore, the correlations between the goal/motive component and the knowledge component were .62 for the interview data and .35 for the questionnaire data. These correlations, though moderate, were all significant ($p < .01$).

Also indicated in the previous analyses was that skilled readers, on average, appeared to obtaincd better scores with the interview method. One possible explanation is that they were more able to answer the questions in a step-by-step format by offering a set of alternatives (e.g., if this then ...; if that then ... etc.) and were therefore given higher scores if one of these alternatives revealed greater metacognitive awareness. To test this hypothesis, t-tests were performed to compare the number of answers provided by skilled and less skilled readers with respect to overall performance, components/categories, and individual items. It was found that skilled readers provided significantly more answers in terms of overall performance [$t(57)=3.96$, $p < .0005$], and the three categories of person [$t(57)=2.88$, $p = .006$], task [$t(57)=2.29$, $p \leq .025$], and strategy [$t(57)=3.28$, $p \leq .002$]. Of the individual items, skilled readers offered significantly more answers ($p < .05$) in six of the 20 items. Interestingly, the only item for which less skilled readers produced significantly more answers than skilled readers was the question "Are there times when you think of yourself as a poor reader?" [$t(57)=2.08$, $p \leq .04$].

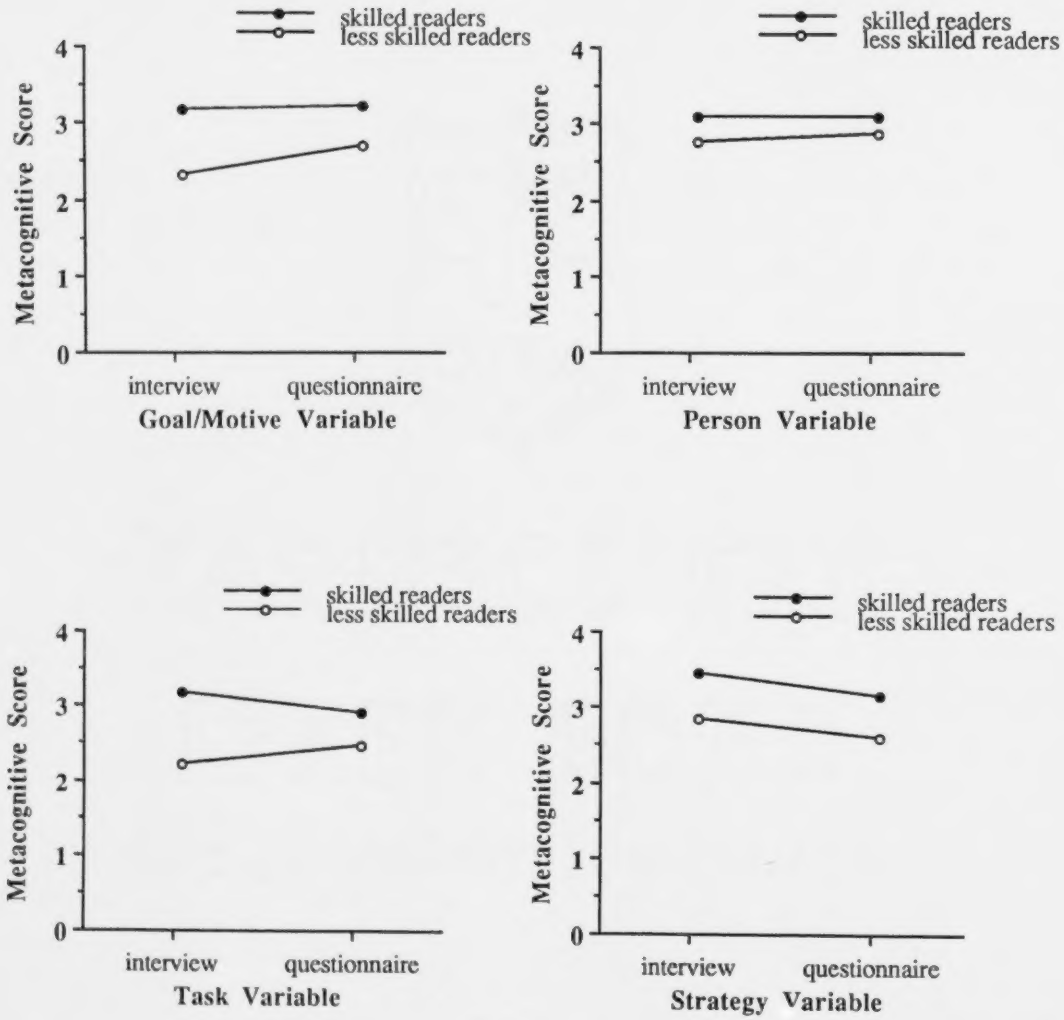
7.3. General Discussion

Study 1 was undertaken in an effort to acquire information about the knowledge and goal/motive dimensions of reading and comprehension monitoring in sixth-grade readers. Another objective was to compare the interview technique and the questionnaire method in assessing metacognition about reading. These two aspects will be discussed in view of the results reported in previous sections.

7.3.1 Relation between Reading Ability and Metacognitive Awareness

Both of the interview and questionnaire results revealed significant differences between skilled and less skilled readers on various aspects of metacognition about reading and comprehension monitoring. As Figure 7-6 shows, skilled readers scored significantly higher in terms of perceived goals/motives ($M = 3.09$). Specifically, skilled readers seemed to view meaning-getting as the goal of reading, exhibit higher self confidence and enjoy reading most of the time. In contrast, less skilled readers tended to maintain a decoding orientation towards reading and display a poor self image as a reader.

Figure 7-6
Comparison of Performance on Four Variables
for Skilled and Less Skilled Readers



With respect to metacognitive knowledge, skilled readers again consistently outperformed less skilled readers on all three categories of metacognitive knowledge about reading (Person, M = 2.97; Task, M = 2.92; Strategy, M = 3.19), as Figure 7-6 demonstrates. In particular, skilled readers displayed greater awareness of certain characteristics of text structure and task demand, and reported greater use of context to solve comprehension problems. It should be noted, however, that less skilled reader displayed a level of understanding of how personal factors affect reading proficiency quite close to that of skilled readers. In fact, they achieved their highest performance on the person variable with a mean of 2.7 for the two measures in comparison to their performance on other variables (Goal/Motive, M = 2.4; Task, M = 2.23; Strategy, M = 2.61). This particular pattern of results is not entirely consistent with the findings of previous studies (e.g., Kirby & Moore, 1987; Moore, 1983). Nevertheless, similar trends were reported when readers of different ages were compared; both younger and older readers were aware of the effects of personal variables on reading (e.g., Myers & Paris, 1978).

In sum, this study provided converging evidence obtained from both interview and questionnaire measures with respect to the relationship between reading ability and metacognitive awareness. Even when verbal demands were minimized, the differences between the two reader groups were still evident in terms of their perceived goals and motives of reading, their awareness of text characteristics and task demands, and the use of context as a reading strategy.

7.3.2 Measuring Metacognitive Knowledge and Motives of Reading

In addition to examining reader differences, another objective of the study was to compare the merits of the two methods in measuring metacognitive knowledge and motives of reading.

As shown in previous sections, the interview responses and the questionnaire responses produced comparable patterns of results. When taking various factors into consideration, the questionnaire format has several advantages. First, it reduces verbal demands upon respondents and requires minimal reading ability when the items are read aloud to the subjects. Thus, it avoids some of the pitfalls of verbal reports raised by some researchers (e.g., Garner, 1987). Second, a multiple-choice questionnaire removes some of the problems associated with experimenter or scoring bias. Third, the alternative choices for each item in the questionnaire developed in this study were based on children's responses and therefore they represented children's knowledge and motives of reading. Fourth, the scoring range of the questionnaire developed in this study provides a broader composite index of metacognitive awareness about reading than most similar instruments available on market (e.g., Jacobs & Paris' IRA, 1987). Finally, the questionnaire takes far less time in terms of administration and scoring and is suitable in both individual and group settings. Also, the administration and scoring of the questionnaire require minimal specific skills; teachers and semi-professionals (e.g., teacher aides) can learn to administer and score it in a fairly straightforward manner and the results provide specific information regarding the child's metacognitive knowledge and motives of reading (e.g., whether or not he/she uses context to solve reading failures). In view of all these advantages, the questionnaire developed in this study seems to be a viable option for assessing readers' metacognitive knowledge and motives of reading.

Although the questionnaire technique has the above advantages over the interview method, the interview procedure also has certain merits that the questionnaire cannot offer. For example, the interview schedule may depict a more complete picture about readers' level of metacognitive awareness about reading in that the open-ended questioning format allows readers' to respond as freely as they wish. Their answers thus also provides insight into their flexibility and strategic planning in using various reading strategies. The significant method effect for the strategy category, that both groups scored better in the interview condition, and the results of the multiple answers, are two indications that the open-ended interview technique may be an avenue in which rich and more comprehensive data, particularly regarding reading strategies, can be obtained.

It appears, therefore, that the usefulness of the two measuring techniques depends on the purpose of assessment. If the purpose of assessment is obtain an overall index of students' metacognitive skills of reading in a limited amount of time, the questionnaire apparently is the choice. On the other hand, to gather further information about individual students' reading strategies, the interview method would be the option. When the interview schedule is chosen, we should bear in mind the effects of its interactive nature upon students' responses. The task order effect of the interview data revealed in the preliminary analyses suggests that it may not be wise for teachers to conduct metacognitive interviews at the very beginning of the school year, or for researchers to have the interview as the first task in experimental research.

7.3.3 Issues for Future Research

While the overall results of the study confirmed findings reported in previous studies that skilled readers demonstrated greater metacognitive awareness about reading than less skilled readers, several specific issues arise from the study. First, the goal/motive component and the knowledge component are the two major constructs examined in this study and the distinction between the two seems apparent. The goal/motive items attempted to measure a reader's (using Brown's [Brown et al., 1983] term) "hot cognition" about reading (e.g., what do you like or dislike about reading) whereas the knowledge items sought to assess one's "cold cognition" about reading (e.g., what does the first sentence usually do for a paragraph or story). Previous studies focused extensively on the cold cognition aspect and rarely explored the hot cognition aspect of reading. As a result, the knowledge construct is more well developed with three distinct subconstructs. To the author's knowledge, this study represents one of the few, if any, studies attempting to link the two aspects in a single interview/questionnaire schedule. Although correlational analyses indicated that the two components were significantly correlated, the relatively small number of items developed for the goal/motive component in this study seems to make equal comparison difficult. Further examination into the goal/motive construct of reading is needed and the possibility of developing subconstructs should be explored.

Another issue also relates to the construct issue discussed above. The validity of the constructs (i.e., goal/motive and knowledge) and subconstructs (i.e., person, task, strategy) examined in this study, has not been empirically verified. A principal components analysis of the interview and questionnaire item scores was attempted. However, due to the small sample size, the factor analysis did not yield the proposed metacognitive factors. Although the person, task and strategy categories of metacognitive knowledge have been widely discussed in recent literature (e.g., Flavell, 1985), their empirical validity has yet to be established. In fact, different categories of metacognitive knowledge have been proposed by other researchers. For example, Paris and his colleagues (e.g., Jacobs & Paris, 1987) classified metacognitive knowledge in terms of evaluation, planning, regulation and conditional knowledge. Kirby and Moore's (1987) factor analysis of their interview schedule yielded four components which were labeled withholding closure, reading skill, semantic selection, and use of context. Future researchers may wish to compare these constructs and examine their empirical validity and utility in investigating the development of metacognition and reading skills.

The third issue relates to the significant differences between skilled and less skilled readers observed in this study. Whereas the quantitative analyses have provided strong evidence concerning skilled readers' advanced metacognitive awareness about reading, a closer look into their patterns of responses seems to reveal some unique qualitative differences between the two groups of readers. In addition to the demonstration of greater metacognitive awareness, skilled readers appeared to be more flexible and well planned in applying their knowledge to different situations. For example, when asked about how to figure out the meaning of an unknown word in reading, one skilled reader presented a plan with a set of alternative strategies: "I'll try to sound it out and if that doesn't work, I'll probably read the words around it and try to figure out what it might be... and if that doesn't work either, I'll look it up in the dictionary." While the multiple answer analyses reported earlier offered some support for skilled readers' flexibility and strategic planning, the scoring scale (which has five scales for each item but allows only one best single answer) developed in this study needs to be reexamined to allow further analysis into these two aspects of metacognitive knowledge. Although Pairs and his associates (e.g., Jacob & Paris, 1987) claimed to investigate readers' planning skills and conditional knowledge in their research, the types of questions they asked and the scoring scale (which has three scales and allows only one best single answer) they used did not yield any insight into the issue raised here. How to measure metacognitive knowledge in terms of flexibility and strategic planning seems to be an avenue that deserves further research.

Some of the non-significant findings in this study also require further clarification. For example, although both skilled and less skilled readers reported the use of imagery and rereading strategies to aid comprehension, how they would apply these strategies to different situations remain unknown. Reformulations of the strategy questions to elicit responses about specific applications may reveal some differences between the two reader groups.

Finally, further validation and refinement of the interview/questionnaire items is needed. Some of the questions may be too ambiguous to elicit meaningful responses even when alternatives are provided (e.g., What makes someone a really good reader?). Reformulating these ambiguous questions is needed if they are to be used as items in future interviews or questionnaires. With respect to the multiple choices for the questionnaire items, it should be noted that they were generated from the responses produced by half of the subjects in this study, the validity of these multiple choices should be further tested. Future research should also consider the possibility of establishing a scoring scale for combined answers, as for certain items one single choice may not represent the best answer.

8. STUDY 2: LEARNING PROCESS QUESTIONNAIRE

While Study 1 was developed to assess the subjects' particular interests and metacognitive awareness of reading, Study 2 was implemented to reveal the subjects' general learning motives and strategies which might also provide insights into their perceived goals/motives for reading and their reading strategies. In this chapter, the method and results of Study 2 are reported. In addition, comparisons of results from Study 1 and Study 2 are also discussed.

8.1 Method

In this study, the *Learning Process Questionnaire* (LPQ, Canadian edition) developed by Biggs and Mulcahy (1988) was used to investigate students' general orientations to learning (see Appendix I). In the subsequent sections, the composition of the LPQ is described, and procedures for administration and scoring are detailed.

8.1.1 Subjects

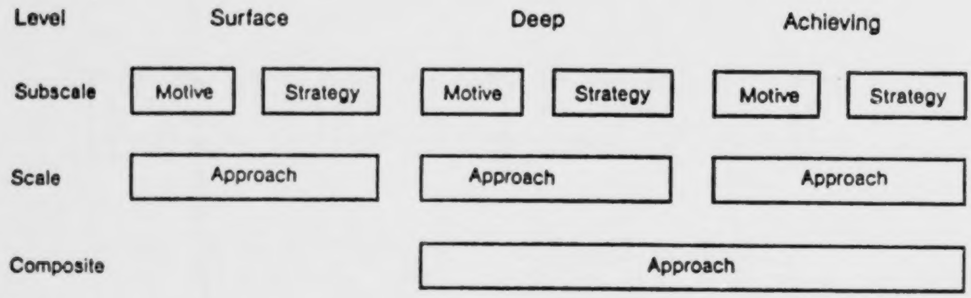
The same 30 less skilled and 29 skilled readers who participated in Study 1 served as subjects for this study.

8.1.2 Materials

The construction of the LPQ was based on a model of student learning developed by Biggs (1987b). The model has been outlined in Chapter 3 . Briefly restated here, in Biggs' model, there are three major approaches to learning: surface, deep, and achieving. These approaches involve different levels of metalearning and lead to qualitatively different learning outcomes. Specifically, each approach is a composite of a motive and an appropriate strategy. Accordingly, the surface approach consists of the surface motive component and the surface strategy component. The surface motive is to meet requirements with minimal effort. The surface strategy is reproductive and is often associated with rote learning. The deep approach comprises the deep motive component and the deep strategy component. The deep motive is to strive for actualizing one's interests, and the deep strategy is to extract maximum meaning by reading widely and interrelating with previous relevant knowledge. The achieving approach also consists of the achieving motive and the achieving strategy components. The achieving motive is to publicly manifest one's excellence, and the achieving strategy is based on organizing one's time and working space. Moreover, it is possible for students to combine an achieving approach with either a surface, or a deep, approach, forming a composite approach such as surface-achieving or deep-achieving. The LPQ operationalizes these learning approaches, and their constituent motives and strategies, in terms of scale and subscale profiles. The profiles reveal a student's general orientation to learning; that is, a composite of motivational states and strategy deployment in learning (Biggs, 1987a).

The LPQ consists of 36 items. The respondents rate themselves on each item on a 5-point Likert scale, from 5 ('This item is *always or almost* true of me') to 1 ('This item is *never or only rarely* true of me'). Each item is a self-report statement of a motive or a strategy. There are six subscales, each containing six items, derived from three motive and three strategy subscales. The sum of the related motive and strategy subscales yields the approach scale scores, while a composite Deep-Achieving/Surface-Achieving scale score can be calculated by summing Deep and Achieving or Surface and Achieving scales. Figure 8-1 illustrates the composition of the LPQ subscale, scale, and composite scores.

Figure 8-1
Composition of LPQ Subscale, Scale, and Composite Scores
(Source: Biggs, 1987b, p.20)



The sampling for the original LPQ was conducted in Australia in 1979 with secondary students (Biggs, 1987b) . From the Australian data, statistical information concerning reliability showed that test-retest reliability coefficients for subscales range from .49 to .70, with internal-consistency coefficients for subscales ranging from .45 to .78. With regard to construct validity, it was reported that scale scores relate to student performance in consistent ways. In short, reliability and validity of the LPQ were judged to be satisfactory.

For the Canadian edition of LPQ (modified slightly to accommodate the Canadian context and for use with elementary students), norming data are being collected (personal communication with Mulcahy, January, 1993). For fourth- and sixth-grade students in

Alberta, the means and standard deviations of the LPQ subscale, scale and composite scores are displayed in Table 8-1. The data revealed a developmental pattern of learning style that there is general increase in deep and achieving scores but decrease in surface scores with grade.

Table 8-1

Means (M) and Standard Deviations (SD) of LPQ Scores for 4th and 6th-Grade Students in Alberta

	Grade			
	Four (N = 165)		Six (N = 168)	
Subscale				
Surface				
Motive	19.51	(4.89)	18.16	(4.42)
Strategy	18.65	(4.16)	17.40	(3.81)
Deep				
Motive	21.61	(4.73)	22.79	(3.38)
Strategy	20.93	(4.56)	21.16	(3.46)
Achieving				
Motive	21.16	(4.15)	21.64	(4.10)
Strategy	21.35	(4.47)	22.01	(3.85)
Scale				
Surface	38.16	(7.10)	35.56	(6.83)
Deep	42.54	(8.33)	43.95	(5.56)
Achieving	42.52	(7.46)	43.65	(6.50)
Composite				
Surface-Achieving	80.67	(11.89)	79.21	(9.50)
Deep-Achieving	85.06	(13.81)	87.60	(10.36)

Note: Standard deviations are in parentheses.

8.1.2 Procedure

The LPQ (Canadian edition) was administered to the subjects in a small group (two to three persons) in a quiet room at school. The tester introduced the LPQ to the subjects and explained the nature of the LPQ. The subjects were told that the purpose of the LPQ was just to know about their feelings about school and how they go about learning in school. It was emphasized that there were no "right" or "wrong" answers to the questions. Their answers would be confidential and therefore they did not have to worry about what their teachers or anyone else might want them to say. They were encouraged to answer as honestly as they could. When forms and answer sheets were given out, the tester read the instructions on the form, tried the examples with the group and checked for understanding. To minimize problems caused by reading difficulties, the tester read each item as the group went through it. Any questions about the meaning of an item were dealt with as non-directively as possible. In other words, the meaning of the item was explained without giving hints to the subjects how they 'should' respond. It took about 20 minutes for the subjects to complete the LPQ.

8.1.3 Scoring

All LPQ items were scored in the same manner. The items were cycled so that every sixth item returns to the particular subscale in the order, from the first item: Surface Motive (SM), Deep Motive (DM), Achieving Motive (AM), Surface Strategy (SS), Deep Strategy (DS), and Achieving Strategy (AS). As mentioned before, motive and strategy scores were subscale scores, and approach scores were scale scores. Subscale scores were obtained by adding every sixth response in the order indicated (e.g., a subject's suface motive subscale scores would be the sum of the scores of item 1, 7, 13, 19, 25, and 31). Accordingly, the range of any one of the motive and strategy subscale scores was from 6 to 30. Scale scores were obtained by adding the appropriate subscale scores, ranging from 12 to 60. Composite scores were calculated by adding the Deep and Achieving or Surface and Achieving scale scores, ranging from 24 to 120.

8.2 Results and Discussion

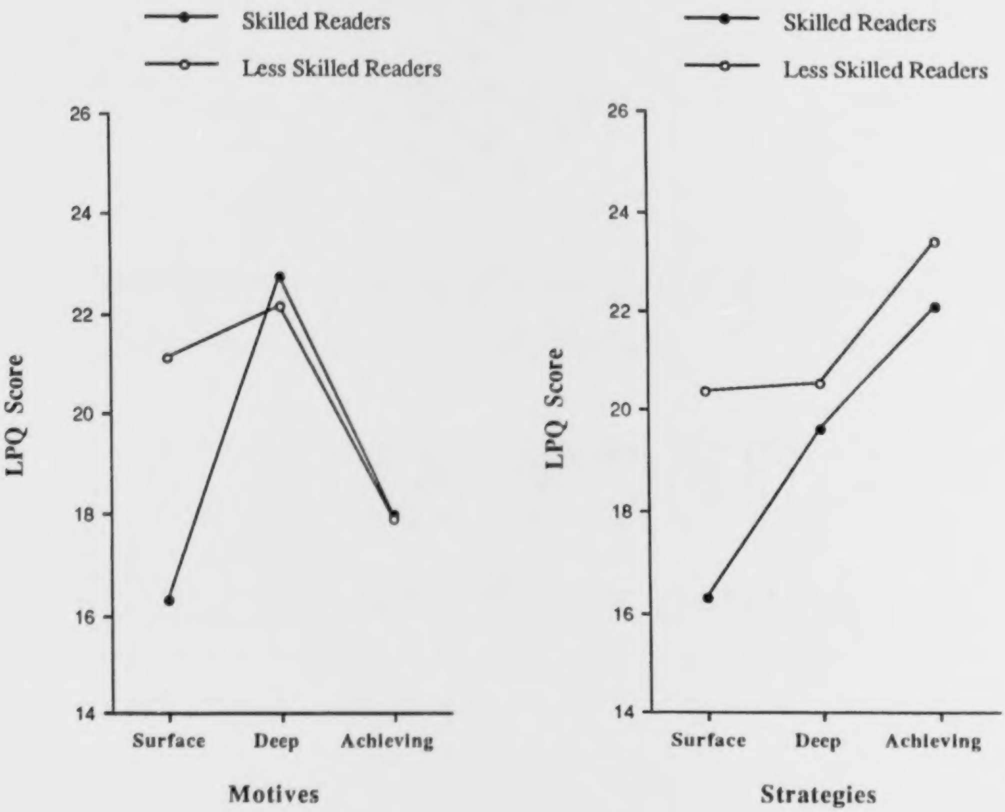
Analyses of results focused on differences between skilled and less skilled readers in responding to the LPQ questions concerning general learning orientations. To compare reader group differences, the data were analyzed in four aspects: (1) learning motive and strategy subscale scores , (2) individual item scores under each subscale, (3) learning approach scale scores, and (4) deep achieving or surface achieving composite scores. Multivariate ANOVAs were performed on the LPQ scores using subscale scores, item scores, scale scores and composite scores as dependent variables.

In addition, to examine the relationships between the subjects' motives and strategies of learning in general as assessed by the LPQ and their motives and strategies of comprehension monitoring in reading as measured by the interview and the questionnaire, Pearson's correlations and multiple correlations were calculated.

8.2.1 Learning Motive and Strategy Scores

The means for each group for each subscale of the LPQ were calculated. Table 8-1 shows the means and standard deviations of the six subscale scores for each reader group. The means are graphically illustrated in Figure 8-2. With reader group as an independent variable and the six subscale scores as dependent variables, a Multivariate analysis of variance was performed. As shown in Table 8-2, the main effect of group was highly significant [F(6,52)=5.847, p≤.0001]. Separate analyses of variance on each subscale revealed that the main effect of group was primarily due to the surface motive scores [F(1,57)=24.15, p≤.001], and the surface strategy scores [F(1,57)=22.08, p≤.0001]. The results suggested that less skilled readers scored significantly higher than skilled readers in terms of surface motives (M=3.52 vs. 2.72) and surface strategies (M=3.39 vs. 2.76). In other words, less skilled readers appeared to adopt surface motives and strategies towards learning more often than skilled readers.

Figure 8-2
LPQ Subscale Scores for Skilled and Less Skilled Readers



In order to pinpoint specific differences between the two groups with respect to surface motives and strategies, two separate MANOVAs were performed, one for the six item scores under the surface motive subscale, and one for items under the surface strategy subscale. The results of the motive items suggested a lack of intrinsic motivation towards learning in less skilled readers, as they scored significantly higher on item 1"I want to take only those subjects in school that would help me get a job, not those that might be more interesting" [F(1,57)=17.82, $p \leq .0001$], item 25 "I don't think that teachers should expect us to work on things that are not part of the school curriculum" [F(1,57)=10.14, $p \leq .002$], and item 31 "I only want to stay in school long enough to get a good job" [F(1,57)=5.34, $p \leq .024$]. In addition, less skilled readers also displayed a lack of self confidence in learning, as revealed by their significantly higher scores on item 19 " Even when I have studied hard for a test, I worry that I may not be able to do well on it" [F(1,57)=4.65, $p \leq .035$]. With surface motives aimed at meeting school requirements with minimal effort, it was not surprising that less skilled readers tended to rely more often on surface strategies such as rote learning. They scored significantly higher on items such as "I prefer subjects in which I have to learn a lot of facts to ones in which I have to do a lot of reading and understanding" [item 16, F(1,57)=13.32 $p \leq .001$], "In most subjects I only work hard enough to make sure I pass" [item 22, F(1,57)=22.89, $p \leq .0001$], and "I find it better to learn just the facts and details about something rather than try to figure it out myself" [item 28, F(1,57)=7.43, $p \leq .009$]. In short, less skilled readers appeared to be more "surface" oriented towards learning than skilled readers.

Table 8-2

Means (M) and Standard Deviations (SD) of LPQ Subscale Scores for Skilled and Less Skilled Readers

	Reader Group			
Subscale	Skilled Readers		Less Skilled Readers	
Surface				
Motive	16.31	(3.78)	21.13	(3.76)
Strategy	16.28	(2.94)	20.37	(3.39)
Deep				
Motive	22.76	(3.61)	22.13	(3.87)
Strategy	19.62	(3.52)	20.53	(3.37)
Achieving				
Motive	17.97	(4.04)	17.90	(3.59)
Strategy	22.07	(3.90)	23.37	(4.55)

Note: Standard deviations are in parentheses.

Table 8-2
Multivariate Analysis of Variance of LPQ Subscale Scores
by Skilled and Less Skilled Readers

Multivariate Test	F	DF	Sig. of F
Wilks Lamda	5.847	6, 52	.000
Univariate F-tests (DF=1,57)			
Subscale	MS	F	Sig. of F
Surface Motive	343.004	24.147	.000
Surface Strategy	222.436	22.081	.000
Deep Motive	5.765	.411	.524
Deep Strategy	12.282	1.035	.313
Achieving Motive	.063	.004	.948
Achieving Strategy	24.832	1.381	.245

8.2.2 Learning Approach and Composite Scores

As mentioned before, an approach scale score was calculated by adding the corresponding motive and strategy subscale scores. A composite score was formed by combining an achieving approach scale score with either a surface or a deep approach scale score. Three approach scale scores, surface, deep, and achieving, and two composite scores, surface-achieving and deep-achieving, were computed for each subject. Table 8-3 displays the means and standard deviations of the three scale scores and the two composite scores for each reader group. The means are graphically illustrated in Figure 8-3. Two separate MANOVAs were performed, one for the scale scores and one for the composite scores. The patterns of results were identical to those reported in the previous section indicating a highly significant main effect of group primarily due to the surface variables (i.e., the surface scale score or the surface achieving composite score; see Appendix J for statistical details of results). In sum, the results of the several MANOVAs all pointed to the significant differences between skilled and less skilled readers in terms of a surface approach towards learning characterized by instrumental motivation and rote learning strategies.

Table 8-3

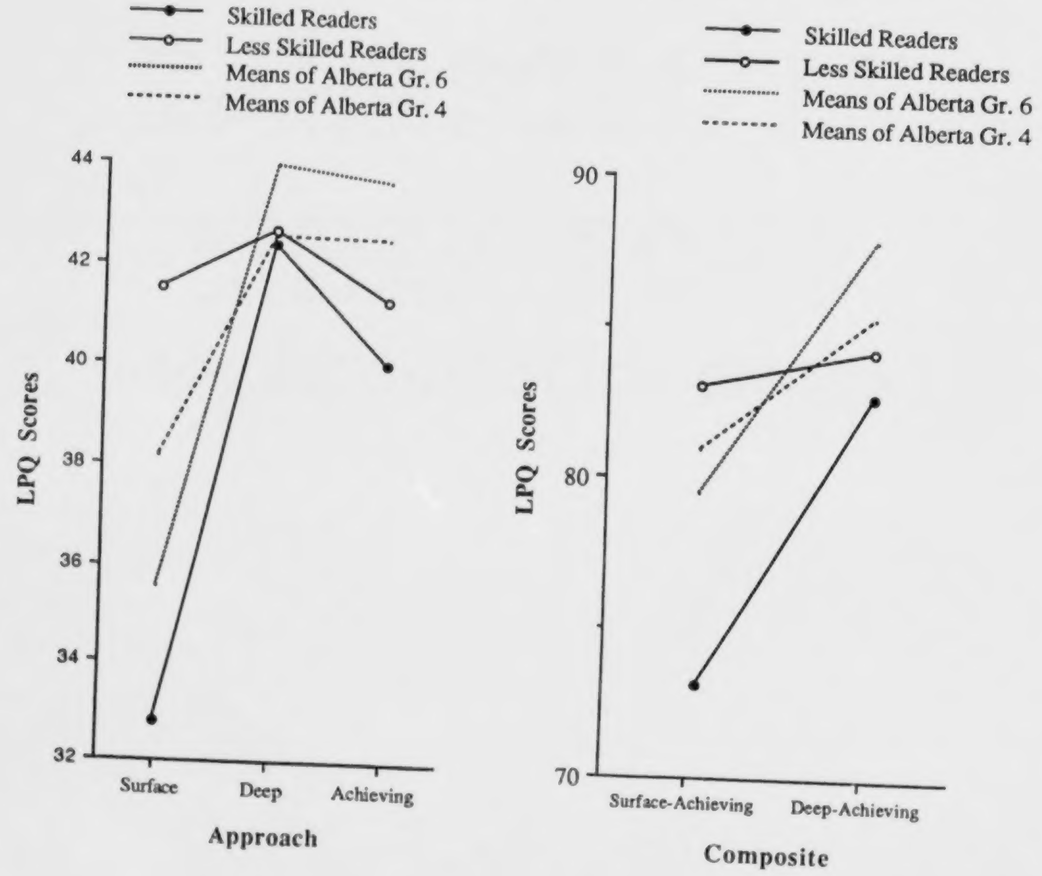
Means (M) and Standard Deviations (SD) of LPQ Scale Scores and Composite Scores for Skilled and Less Skilled Readers

Scale/Composite	Skilled Readers		Less Skilled Readers	
Scale				
Surface	32.79	(5.82)	41.50	(6.07)
Deep	42.37	(6.21)	42.67	(6.59)
Achieving	40.03	(6.31)	41.27	(6.48)
Composite				
Surface-Achieving	72.83	(4.04)	82.77	(10.99)
Deep-Achieving	82.41	(3.90)	83.93	(11.78)

Note: Standard deviations are in parentheses.

Figure 8-3

LPQ Scale and Composite Scores for Skilled and Less Skilled Readers



On the other hand, the non-sigificant findings on the deep and achieving variables between skilled and less skilled readers seemed to indicate that both groups were not different in these aspects. Further comparison of both groups' performance against the means obtained for Alberta students, however, provided another perspective for interpreting the results. As mentioned earlier, the data collected from Alberta elementary schools revealed a developmental pattern of learning orientation: general increase in adopting deep and achieving approaches but decrease in accepting the surface learning approach with grade. As illustrated in Figure 8-3, the profile of less skilled readers was closer to the grade-four profile than to the grade-six profile. In fact, less skilled readers scored even higher than the typical Alberta grade-four student on the surface scale. Their seemingly flat profile, compared to that of the grade-six sample, suggested that they did not differentiate the three learning approaches. Their non-differential adoption of all three approaches may be an indication of a lack of awareness and control of their own learning processes. In contrast, the profile of skilled readers was comparable to that of the typical Alberta grade-six student indicating a preference of deep and achieving approaches to the surface learning approach. Their profile of scores reflected that they were aware and in control of their own learning process. It was thus argued that, although less skilled readers obtained scores on deep and achieving variables similar to those of skilled readers, profile comparisons with the Alberta sample suggested that they did not display an awareness of the learning process comparable to that of skilled readers. Using Biggs' (1987b) term, they were not competent "metalearners" as they displayed little insight into the how and why of their learning activities (i.e., every learning approach appeared to be the same for them). In this context, it seems now appropriate to examine the relationship between metacognition in learning and metacognition in reading. Relevant results from Study 1 and Study 2 will be compared and analyzed in the following sections.

8.2.3 Correlational Analyses

In order to explore the relationships among reading comprehension performance, motives and strategies in learning, and motives and strategies in reading, CTBS comprehension scores from student records were correlated with LPQ variables (examined in Study 2) and Interview/Questionnaire goal/motive and strategy variables (investigated in Study 1) for the total group of 59 subjects. Correlations were computed first using CTBS comprehension scores, LPQ subscale scores, and Interview/Questionnaire goal/motive scores and strategy scores,and then using CTBS comprehension scores, LPQ scale scores and Interview/Questionnaire goal/motive plus strategy sum scores. Since the patterns of correlations were essentially identical, for the sake of parsimony, the second set of correlations would be used for discussion. Theses correlations are shown in Table 8-4.

Table 8-4
Correlations for Reading Comprehension (CTBS), LPQ and Interview/Questionnaire Variables (N=59)

Variables	INGMST	QUGMST	LPQSAP	LPQDAP	LPQAAP
CTBS	.62***	.59***	-.62***	-.02	-.10
INGMST		.54***	-.47***	-.02	-.05
QUGMST			-.55***	.01	.02
LPQSAP				.19	.26*
LPQDAP					.55***

Note: CTBS=Canadian Test of Basic Skills reading comprehension scores;
INGMST=Metacognitive Interview goal/motive and strategy sum scores;
QUGMST=Metacognitive Questionnaire goal/motive and strategy sum scores;
LPQSAP=LPQ Surface Approach Scores; LPQDAP=LPQ Deep Approach Scores;
LPQAAP=LPQ Achieving Approach Scores;
*p<.05, ***p<.001

Reading comprehension was strongly and positively correlated with reading goals/motives and strategies as revealed in the interview (r=.62) or in the questionnaire (r=.59), but negatively correlated with surface learning motives and strategies (r=-.62). This pattern of correlations indicated that better reading performance is associated with greater awareness of reading goals and strategies, and with less passive learning motives and rote learning strategies. The correlations between reading comprehension and the deep and achieving learning variables were not significant. These non-significant findings may be partly related to less skilled readers' non-discriminative reactions to all three approaches as argued in the previous section. It was also possible that "deep-related scores may not be related to performance unless the student is intrinsically interested in the task", as Biggs (1987, p.39) suggested. In fact, Biggs (1987b) obtained similar patterns of correlations between LPQ scores and performance variables for secondary students in Australia. For his sample, surface-related scores correlated consistently with poor academic performance, however measured; in contrast, deep- and achieving-related scores correlated barely with the English subject. Biggs contended that the deep or deep-achieving approach "should relate most strongly to performance in the favourite subject of the student, and marginally, if at all, in other subjects" (p.39). In the present study, although the subjects were classified as skilled and less-skilled readers based on their reading performance at school (e.g, CTBS scores, teacher's ratings), whether they were intrinsically interested in academic learning, or specifically, in reading as an academic subject, was not clearly known.[1]

With respect to the intercorrelations among learning orientations and reading approaches, the surface learning approach was negatively correlated with reading motives and strategies (r= -.47 for interview items and r=-.55 for the questionnaire items). The achieving approach was strongly correlated with the deep approach (r=.55) and somewhat correlated with the surface approach (r=.26). Reading motives and strategies were barely related to deep and achieving approaches. As argued before, this pattern of results may be partly related to less skilled readers' non-discriminative responses to all three approaches. Furthermore, it should be noted that the items regarding reading motives and strategies asked in the interview or questionnaire were domain-specific while the items for LPQ deep and achieving motives and strategies were domain-general in nature. It is speculated that non-significant correlations between reading motives/strategies and deep and achieving motives/strategies may thus be partly due to the different nature of the questions.

8.2.4 Hierarchical Regression Analysis

As mentioned before, Study 2 was implemented to reveal the subjects' general learning motives and strategies and how this information would provide insights into our exploration of the relationship between reading performance and metacognition in reading and comprehension monitoring. To determine if addition of learning motives and strategies measures would improve prediction of reading comprehension performance beyond that accounted for by reading motives and strategies measures, a hierarchical regression analysis was performed with interview/questionnaire reading motives and strategies sum scores and LPQ scale scores as predictors, and CTBS comprehension scores as the criterion variable. Reading motives and strategies measured by interview and questionnaire were entered as a block at step 1, LPQ surface approach scores at step 2, with LPQ deep approach scores and achieving approach scores entered as a block at the final step. The results are presented in Table 8-5.

---

[1] The term "reading" used in the interview or questionnaire items was intended to describe reading as a general activity for both academic purposes as well as for leisure. Therefore, although the interview and questionnaire results indicated that skilled readers, in contrast to less skilled readers, seemed to enjoy reading most of the time , the findings did not necessarily imply that they were intrinsically motivated in reading as an academic subject.

Table 8-5

Hierarchical Regression Analysis on Reading Comprehension Using Interview/Questionnaire and LPQ Variables as Predictors

(N=59)

Step entered	Variable	Beta Weight[a]	Multiple R	R^2	Increase in R^2
1.	QUGMST	.59			
	INGMST	.41	.684	.47	.47***
2.	LPQSAP	-.34	.737	.54	.07**
3.	LPQDAP	.06			
	LPQAAP	-.09	.743	.55	.01

Note: INGMST=Metacognitive Interview goal/motive and strategy sum scores; QUGMST=Metacognitive Questionnaire goal/motive and strategy sum scores; LPQSAP=LPQ Surface Approach Scores; LPQDAP=LPQ Deep Approach Scores; LPQAAP=LPQ Achieving Approach Scores;

**p<.01 ***p<.001

[a] This column reflects Beta weights after variables were entered.

As Table 8-5 displays, reading goals/motives and strategies measured by interview and questionnaire accounted for 47% of the variance in reading comprehension [F(2,56)=24.61, $p \leq .001$]. Addition of LPQ surface approach scores made a significant improvement in prediction [F_{ch}(1,57)=9.17,$p \leq .004$], accounting for 7% of the residual variance. Addition of LPQ deep and achieving approach scores to the regression equation, as expected because of the correlations obtained before, did not reliably improve the prediction of reading comprehension performance.

8.3 General Discussion

Study 2 was carried out in an attempt to gather information about grade-six readers' general learning orientations. Another objective of study 2 was to compare their general learning orientations with their reading approaches as assessed in Study 1. These two aspects will be discussed in view of the results reported in previous sections.

8.3.1 Relation between Reading Ability and Learning Approaches

The results of of the MANOVAs and those of the correlational and multiple regression analyses, put together, were consistent in demonstrating that in terms of learning approaches, the difference between skilled and less skilled readers was most evident in surface motives and strategies. Less skilled readers' significant higher scores indicated that they appeared to view school learning as an "unavoidable" task, and tended to get through it with minimal effort by relying on rote learning strategies for which extra work or reasoning is not required. In contrast, skilled readers' lower scores revealed that they did not rely on the surface approach to learning as much as less skilled readers did. The relationships between reading ability and deep and achieving learning approaches, as reported in the previous sections, were not quite clear. As Biggs (1987, p.39) pointed out, "deep-related scores are not expected to relate to performance unless the student is intrinsically interested in the task". Further research is needed to clarify the relationships among intrinsic motivation, learning approaches, and reading performance.

8.3.2 Metacognition in Reading and Metacognition in Learning

Another objective of this study was to examine how domain-specific motives and strategies (in this case reading comprehension) are related to domain-general learning motives and strategies. On the one hand, the strong negative correlation between reading motives/strategies and surface motives/strategies suggested that metacognition in reading to a certain extent is related to metacognition in learning because the surface approach represents limited metacognitive awareness of learning. Moreover, profile comparisons of the two reader groups against the Alberta samples revealed marked difference between the two groups, with the less skilled readers group showing a 'no-preference' profile and the skilled reader group showing a 'deep-achieving preference' profile. It is argued that skilled readers' profile was an indication of greater learning metacognitive awareness because they chose the deep and achieving approaches over the surface approach. On the other hand, the results of the correlational and multiple regression analyses revealed that reading motives and strategies did not seem to be related to the deep approach, which theoretically involves the greatest degree of metalearning (Biggs, 1985). It has been argued before that this pattern of relationship may be partly due to less skilled readers' non-discriminative responses to all three learning approaches and partly due to the different nature of questions asked in the interview/questionnaire and in the LPQ. It should be mentioned that significant positive correlations between the metacognitive questionnaire items and the LPQ deep approach items were obtained in another study (Peat, in progress). Whereas the subjects in this study were two reader groups representing the two ends of the reading continuum, the subjects in Peat's study were from regular classrooms with a broader range of reading performance. The discrepant findings may be partly related to the different nature of the two study samples. In sum, while the present study provided some evidence that metacognition in reading is related to metacognition in learning, more well defined research is needed to delineate the specific nature of the relationship between domain-specific metacognitive awareness in reading and domain-general metacognitive awareness in learning.

9. STUDY 3: ERROR DETECTION TASK

This study was designed to examine the subjects' comprehension monitoring processes, strategies, and attributional beliefs related to comprehension monitoring and comprehension performance. In this chapter, the method of this study is first presented, analyses of data are then reported and results discussed.

9.1 Method

As discussed in chapter 4, many investigations of the monitoring process and strategies have utilized the error detection paradigm with no control of confounding variables, evaluation standards, and passage difficulty. In addition, in most studies, comprehension monitoring measures were not obtained in conjunction with comprehension performance measures to examine linkage between comprehension monitoring behavior and comprehension performance. In this study, the error detection task was designed to avoid the above mentioned problems.

9.1.1 Subjects

The subjects were the same subjects who participated in Study 1 and Study 2. There were 30 less skilled readers and 29 skilled grade-six readers.

9.1.2 Materials

The reading materials for the error detection task consisted of six expository passages and their corresponding set of comprehension questions. The following criteria were set up for constructing the passages:

1. *Source*: The six passages and their corresponding comprehension questions were adapted from several standardized reading/achievement tests: three from the Stanford Diagnostic Reading Test (1976, Green Level, Form A, and Brown Level, Form A), two from the Nelson Reading Skills Test (1977, Level B, Form 4), and one from the California Achievement Test (1970, Level 3, Form A). The rationale for selecting passages from standardized tests was based on the fact that the reliability and validity of these tests have been judged to be very satisfactory (Salvia & Ysseldyke, 1991); the reading passages of these tests were carefully selected and the comprehension questions were well designed.

2. *Content:* All six passages were expository in nature. Non-fiction expository passages were selected because they resemble the typical reading materials the subjects encounter in the school setting. To examine the possibility of background knowledge as a confounding variable in interpreting the error-detection results, an informal questionnaire, Background Knowledge Questionnaire, constructed by the author, was distributed to the subjects before the testing began (i.e., prior to Study 1). The questionnaire assessed the subjects' background knowledge related to the content of the selected passages; they were asked to rate their familiarity with the topics on a 5-point Likert scale from 5 (I know everything or almost everything about this) to 1 (I know very little or almost nothing about this). (See Appendix K.)

3. *Readability*: Two versions of the six passages were constructed, with one version at grade four reading level and the other at grade six reading level as measured by the Fry Readability Scale (1977). Every attempt was made to maintain equal amounts of information between the two versions of each passage. The grade four version was given to the less-skilled reader group whereas the grade six version was read by the skilled readers. In most previous studies, skilled and less-skilled readers were given passages of the same reading level. As a result, skilled readers usually read passages far below their reading level while less-skilled readers read passages at or above their reading level. The reading level of the passages thus was a confounding variable in interpreting the results. In the present research, the reading levels of the reading materials were adjusted to minimize this problem.

4. *Length:* All of the passages were roughly comparable in length, ranging from 113 to 140 words across versions. While the number of words for the two versions of each passage was more or less the same, the grade-four versions, because of the use of simple sentence structure, usually contained more sentences than their corresponding versions at grade-six level. For the grade-six version, the passages were from 10 to 12 sentences in length. For the grade-four version, the passages contained 11 to 15 sentences. However, it should be noted that, although the passages of the grade-six version consisted of fewer sentences, they contained the same number of statements as those of the grade-four version when they were presented to the subjects. Specifically, a complex sentence in the grade six version would be parsed into several statements which essentially corresponded to simple sentences in the grade-four version. As a result, the two versions of each passage contained the same number of statements when they were presented to the subjects statement by statement via a microcomputer. It was

therefore possible to make comparisons between the two reader groups regarding the reading time on each statement and the number of look-backs on each statement.

5. *Error insertion procedure*: Of the six passages, three passages were modified to contain "errors". Three types of error were created or inserted in each of the three passages following the procedures used by Paris and Myers (1981), and by Baker (1985a). Each passage contained one instance of each error type:
   a. nonsense word: a nonsense word was created by rearranging the letter sequence of an original word in the passage to form a phonologically acceptable nonsense words. The substitutes always replaced nouns that appeared near the end of a sentence and were two-syllable nonsense words. It was hypothesized that nonsense words could be identified by effective use of a lexical standard of evaluation.
   b. nonsense phrase: By rearranging the word order within two clauses, a nonsense phrase was produced. It was assumed that nonsense phrases could be identified by effective use of a syntactic standard of evaluation.
   c. inconsistent sentence: Internal inconsistency was created by making one sentence in the passage conflict with a previously presented sentence. In each passage, there were three to four sentences separating the two target sentences. It was assumed that inconsistent information could be identified by effective use of a semantic standard of evaluation.

   The three nonsense errors were scattered throughout each of the three passages with the stipulation that none of the changed information directly affected the answers to the five corresponding comprehension questions of each passage. Moreover, the first and last sentences of each passage were left intact to maintain overall cohesiveness of the passages.

As a result, three "problematic" passages (each contained one instance of the three error types) and three intact passages constituted the reading materials of the error detection task (see Appendix L). The following table illustrates the topic, type, and source of the passages, and the number of words, sentences and statements for each version of the passages.

Table 9-1 Composition of the Error-detection Passages

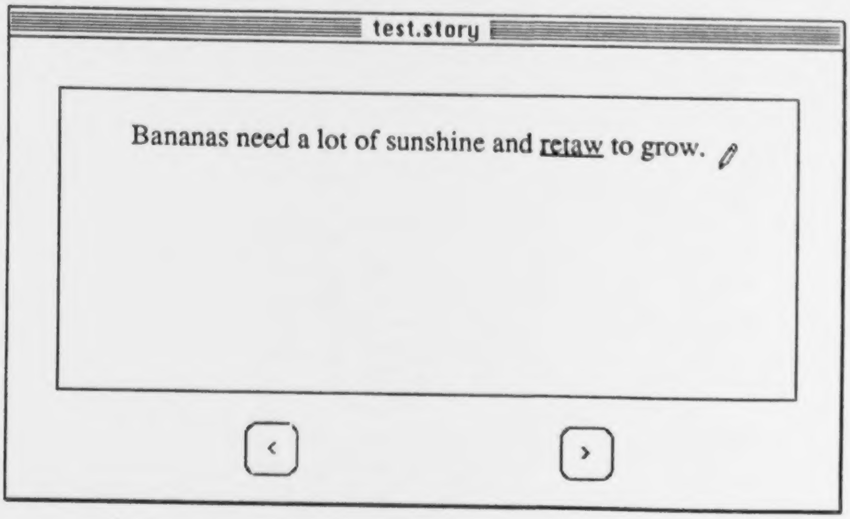
Topic	type	source	grade	words	sentences	statements
Banana	error inserted	Stanford	4	113	11	12
			6	115	10	12
Polar Bears	error inserted	California	4	120	14	14
			6	128	11	14
Opera Singer	error inserted	Stanford	4	137	15	16
			6	139	12	16
Rodeo Clown	intact	Nelson	4	129	12	14
			6	128	10	14
Pottery	intact	Stanford	4	140	14	17
			6	140	10	17
Penguins	intact	Nelson	4	121	13	14
			6	114	10	14

9.1.3 Equipment and Software

An Apple Macintosh Plus microcomputer with 800K main memory and one 800K floppy drive was used for administering the error detection task, along with an on-line processing program developed by University of Alberta Computing Services. This on-line processing program allows the display of three different types of text: introductory messages, experimental reading passages, and comprehension questions. Specifically, the introductory message is presented on the computer screen in one paragraph, detailing the purpose and procedure of the task. The experimental reading passages are displayed on the computer screen one statement at a time. The student can examine each in succession, using the mouse to press the "right arrow" button to indicate that a statement has been read. He/she can also back up to a previous statement by pressing the "left arrow" button. All or part of the statement can be underlined by using the mouse. This allows the student to indicate "problems" that may appear in the statement. The reading time, the underlined text, and the number of times each statement is read are automatically and accurately recorded. When an entire passage has been read, a list of five questions follows. One question is displayed at a time along with four multiple choice answers. The student can press the button next to the answer to indicate his/her choice. Again, the response is automatically recorded. This system is considered user-friendly since the mouse is the only input device the student needs. Figure 9-1 illustrates a sample statement display with a portion of the text underlined.

Figure 9-1

A Sample Statement Display, with Underlined Text, on the Computer Screen



Bananas need a lot of sunshine and retaw to grow.

9.1.4 Procedure

The error detection task was administered to the subjects on an individual basis in a quiet room separate from their classroom. To ensure that the task would not be too tiring for the subjects, they were tested in two periods, approximately one week apart. Each testing period took about 30 minutes. In the first period, they were told that they were going to read six stories on two occasions, three stories at a time, and that some of the stories contained problematic information. They sat in front of the microcomputer and were provided with general information about how to use the mouse to control text presentation or underline all or part of the presentation that they thought was a problem. They were given an opportunity to practise with two short warm-up passages, one of which contained problems. After completing the two practice passages, the subjects went on to the three experimental passages. In the second period, the general procedure was reviewed. On both occasions, care was taken to ensure that the subjects understood the task by reminding them, if necessary, to underline problematic information as soon as they encountered it. However, they were not given feedback as to whether or not they had correctly identified the intended problems. They were also told that they could go back to the previous sentences whenever they wished, and that going back was just like rereading a page in a book. In addition, they were reminded that they were to answer some questions after they finished reading each passage. As they were not allowed to go back to the passage when they were answering the questions, they were advised that they should read the passage until they were ready to answer the questions.

To test the effect of the specificity of instructions, half of the subjects of each group were randomly assigned to one of the two instructional conditions. In both conditions, the subjects were told that their job was to understand the passages as best as they could and by using the mouse of the computer, underline problems that had been intentionally introduced into some of the passages. For the subjects who were assigned to the general instructional condition, problems were simply defined as "something that might confuse people or something that people might have trouble understanding" (Baker, 1985a, p. 303). Subjects who were assigned to the specific instructional condition were given further information about the exact nature of the deliberately inserted problems and two examples of each type. The terms used to describe the three types of problems were: (a) words that aren't really words; (b) words in part of a sentence that aren't in the right order; and (c) two sentences of the passage that don't make sense together (adapted from Baker, 1985a). The passages were randomly presented, with the intact passages counter-balanced with the error-inserted passages.

After the subjects finished reading a passage and answered the corresponding comprehension questions, the tester then asked them to rate their confidence of their comprehension by presenting them the question "How many (0 to 5) questions do you think you got correct in this story?" Their answer was recorded. After the subjects finished reading all six experimental passages and completed their confidence rating, the tester randomly selected the three lowest ratings as comprehension failures and the remaining three ratings as comprehension successes.[1] The subjects were then asked of each success item, "For the passage about ... (topic), you said that you got ... (number) questions correct. Why do you think you got so many questions correct?" They were asked to choose one of the four answers presented to them in card form: because you're smart, because you tried hard, because the story was easy, or because you're lucky. For each failure item, the subjects were asked, "For the passage about ... (topic), you said that you got only... (number) questions correct. Why do you think you missed some questions?" They were also asked to choose one of the four answers presented to them in card form: because you aren't smart enough, because you didn't try hard, because the story was too difficult, or because you weren't lucky. The six items were asked in the following sequence: success-failure-failure-success-success-failure. The order of the four attributional causes (ability, effort, task difficulty, luck) was randomized for each item.

---

[1] In some cases (four out of 59 cases) when there were more than three perfect (5=100%) ratings, the tester tried to compare the subject's ratings with his/her actual scores and chose the three lowest scores as comprehension failures.

9.2 Data Scoring, Results, and Discussion

This section is divided into four parts. The first part examines subjects' background knowledge of the experimental passages and their comprehension performance on these passages. The second part focuses on subjects' monitoring processes. Their use of strategies in regulating their comprehension is then analyzed. Finally, findings on subjects' attributions of their comprehension successes or failures are reported.

9.2.1 Content Knowledge and Comprehension Performance

As revealed in the literature, domain-specific knowledge has been considered an extremely important factor affecting comprehension performance (e.g., Garner, Alexander, & Hare, 1992; Schneider, Korkel, & Weinert, 1990); that is, comprehension performance is highly dependent on one's familiarity with the content . Accordingly, one argument concerning comprehension performance differences between skilled and less skilled readers is that their differences may, at least in part, be attributed to differences in knowledge base. Furthermore, it has been demonstrated that domain experts often do not need to apply many comprehension monitoring strategies in order to aid comprehension and recall of information (e.g., Borkowski, Carr, & Pressley, 1987).

To examine the possibility of content knowledge as a confounding variable in interpreting the results of this study, subjects' background knowledge related to the contents of the six selected passages was assessed by the Background Knowledge Questionnaire described in the materials section. The subjects were asked to rate their familiarity of the topics on a 5-point Likert scale from 5 (knowing almost everything) to 1 (knowing almost nothing).[2] The means and standard deviations of the familiarity ratings of the six topics for the two groups are presented in Table 9-2. Separate t-tests were performed to compare the two reader groups on their ratings of familiarity with the six selected topics. No significant differences were found between the two reader groups in how familiar they were with the selected topics [t(57) values ranged from 0.3 to 1.81, $p>.05$]. The overall average ratings for the six topics for skilled and less skilled readers were 2.67 and 2.46 respectively, indicating that both groups were somewhat, but not very, familiar with the selected topics. In other words, the two reader groups were not significantly different in terms of background knowledge, as judged by themselves, of the topics selected for the experimental passages. Also, their ratings suggested that they did not claim expertise in those areas; it was then unlikely that familiarity with the contents would reduce their applications of comprehension monitoring evaluations and regulations, as would in some cases of domain experts (e.g., Borkowski, Carr, & Pressley, 1987). In addition, subjects' background knowledge ratings of each topic were correlated with their comprehension scores on the passage of the corresponding topic. None of the correlations reached significance (p>.05). The possibility of content knowledge as a confounding variable in interpreting the subsequent results seemed minimal.

---

[2] They were told that the tester was interested in knowing about how much they knew about certain topics; however, they were not informed that they were going to read passages about these topics.

Table 9-2

Means and Standard Deviations of Background Knowledge Ratings

	Reader Group				
Topics	Skilled Readers		Less Skilled Readers		t Value
Bananas	2.10	(0.90)	1.73	(0.94)	1.54
Polar bears	3.17	(0.81)	3.03	(1.22)	0.52
Opera singers	2.55	(1.15)	2.23	(1.25)	1.02
Rodeo clown	2.48	(1.38)	1.90	(1.06)	1.81
Pottery	2.62	(1.08)	2.53	(1.07)	0.30
Penguins	3.07	(0.92)	3.30	(1.12)	0.87
Average rating	2.67	(0.70)	2.46	(0.70)	1.25

Note: Standard deviations are in parentheses.

Another possible confounding variable, decoding difficulty, was controlled by administrating the grade-four versions of the passages to less skilled readers and the grade-six ones to skilled readers. With the two major confounding variables controlled, would there still be comprehension performance differences between the two groups?

The means and standard deviations of the comprehension scores for the two reader groups on the six passages are displayed in Table 9-3. It can be seen that, in spite of similar levels of content knowledge and simplified vocabularies and sentence structures, less skilled readers consistently scored lower than did skilled readers on all six passages. More importantly, they scored significantly lower than did skilled readers on five of the six reading passages [t (57) values ranged from 2.19 to 6.58, p<.05]. The overall average comprehension scores for the six passages for skilled and less skilled readers were 4.22 (84%) and 3.30 (66%) respectively. What might have accounted for their comprehension performance differences?

Table 9-3

Means and Standard Deviations of Comprehension Scores

	Reader Group				
Passage	Skilled Readers		Less Skilled Readers		t Value
Bananas	3.55	(0.95)	2.97	(1.10)	2.19*
Polar bears	4.52	(0.57)	3.67	(1.03)	3.94***
Opera singers	4.72	(0.53)	3.60	(1.07)	5.14***
Rodeo clown	4.14	(0.79)	3.33	(1.12)	3.19**
Pottery	4.52	(0.69)	2.77	(1.28)	6.58***
Penguins	3.90	(1.05)	3.47	(1.31)	1.40
Average scores	4.22	(0.38)	3.30	(0.56)	7.39***

Note: The maximum comprehension score is 5; standard deviations are in parentheses.
*p<.05, **p<.01, ***p<.001

9.2.2 Analyses of Monitoring Processes (Evaluations)

It was hypothesized that the two reader groups' comprehension performance differences might be, in part, related to differences in their monitoring processes; i.e., that skilled readers monitored and evaluated their comprehension more often than did less skilled readers. On-line and off-line measures were employed to test this hypothesis. There were three on-line measures: the number of errors correctly detected, reading times of target sentences, and the number of errors falsely identified. They were on-line measures of the monitoring process because they measured students' evaluation of understanding while they were reading. Comprehension performance prediction, another measure of the monitoring process, was an off-line measure because it measured students' evaluation of understanding after they finished reading.

Error detection. Three scoring methods were attempted to score subjects' error detection. According to the first scoring method, to receive a full credit (i.e., 1 point) for a correct error identification, students had to underline the whole nonsense word or nonsense phrase. For inconsistencies, they received a full credit if they underlined either the latter inconsistent sentence only (or the critical words in the sentence that contained the inconsistent information), or both first and latter inconsistent sentences (or the critical words in those sentences). For students who underlined only part of the nonsense word or phrase, or only the first inconsistent sentence (or critical words in the first sentence), partial credits (i.e., 0.5 point) would be given. The second scoring method (method 2) was more stringent than the first one, in that only full credits were recorded (i.e., partial credits would be scored as zero in the second scoring method). The third scoring method (method 3) was the least stringent method, in that partial credits as recorded in the first scoring method would be credited as full credits (i.e., partial or complete underlying of an error would be scored as 1 point). The rationale for using three different scoring methods was to investigate whether different scoring methods would produce different patterns of results. The data from each scoring method were subjected to a 2 (reader group) x 2 (instructional condition) x 3 (error type) analysis of variance. Reader group and instructional condition were between-subject factors whereas error type was a within-subject factor. For reader group, skilled readers and less-skilled readers were the levels. For instructional condition, general instruction and specific instruction were the trials. Nonsense words, nonsense phrases, and inconsistent sentences were the three levels of error type.

The analyses for the error detection scores using the above three scoring methods provided essentially identical patterns of results. For ease of discussion, the ANOVA performed on the data from the first scoring method is the basic analysis reported here. See Appendices M and N for the ANOVA results, and the means and standard deviations of the error detection scores from method 2 and method 3.

Table 9-4

Means and Standard Deviations of Error Detection Scores

		Error Type					
Instruction	Group	Word		Phrase		Sentence	
General	Skilled	1.40	(1.18)	1.63	(0.72)	1.17	(0.80)
	Less Skilled	1.40	(0.83)	0.73	(0.65)	0.70	(0.84)
Specific	Skilled	2.36	(0.75)	1.71	(0.73)	1.86	(0.93)
	Less Skilled	1.33	(1.18)	1.10	(0.74)	1.00	(0.93)

Note: The maximum error detection score is 3 for each error type.
Standard deviations are in parentheses.

Table 9-5

ANOVA for Error Detection Scores:

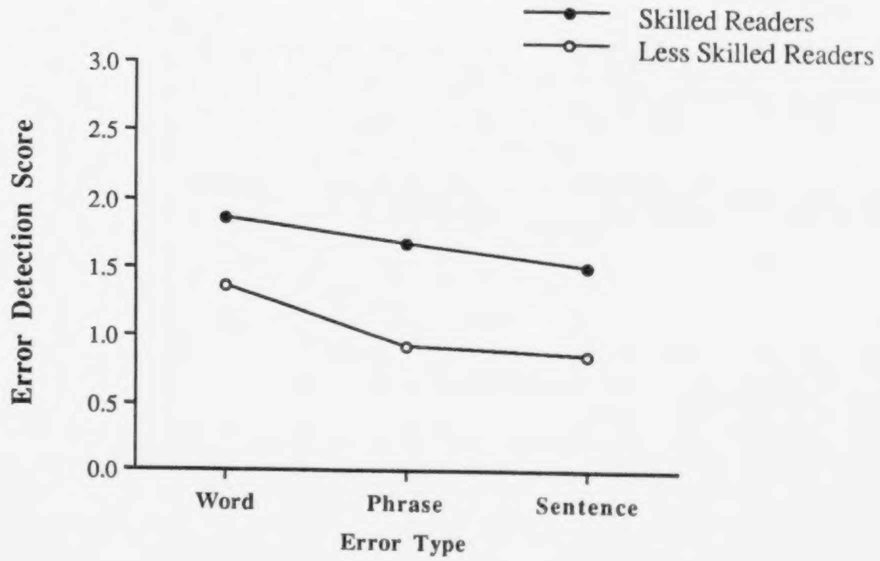
2 (Reader Group) x 2 (Instruction) x 3 (Error Type)

Source	DF	MS	F	Sig. of F
Between				
A (Reader Group)	1	18.32	19.94	.001
B (Instruction)	1	6.66	7.25	.009
A x B	1	1.56	1.70	.197
Error	55	0.92		
Within				
C (Error Type)	2	3.10	4.56	.013
A x C	2	0.23	0.33	.719
B x C	2	0.31	0.45	.637
A x B x C	2	1.58	2.32	.103
Error	110	0.68		

Table 9-4 displays the means and standard deviations of error detection scores (from method 1) for the two groups. Results of the ANOVA are presented in Table 9-5. A highly significant main effect for group [$F(1,55)=19.94$, $p \leq .001$] was obtained, indicating that skilled readers detected more errors ($M=1.68$, 56%) than did less skilled readers ($M=1.04$, 35%). Since error detection is an indication of comprehension monitoring, the result suggested that skilled readers monitored their comprehension more successfully than did less skilled readers. Pairwise comparisons using the Tukey procedure indicated that skilled readers identified significantly more nonsense phrases and internal consistencies than less skilled readers (Tukey's HSD = 0.66, $P < .05$), while the difference between the two groups' identifcations of nonsense words was not significant (see Figure 9-2). As Baker (1985b) pointed out, identification of nonsense words reflected the use of a lexical standard for evaluating and monitoring comprehension, nonsense phrases the use of a syntactic standard, and inconsistent sentences the use of a semantic standard. The above pattern of results indicated that skilled readers were more able than less skilled readers to apply the syntactic and semantic standards to evaluate comprehension.

Figure 9-2

Mean Error Detection Scores of Skilled and Less Skilled Readers



A reliable main effect of instructional condition was also obtained [$F(1,55)=7.248$, $p \leq .009$]. Students who received specific instructions as to the types of problems they should identify correctly underlined more problems ($M=1.55$, 52%) than those who were simply informed that problems would be present ($M=1.17$, 39%). This result revealed that specific instructions improved comprehension monitoring performance. In addition, the main effect of error type was significant [$F(2,110)=4.56$, $p \leq .013$].[3] More nonsense words ($M=1.62$, 54%) were detected than were nonsense phrases ($M=1.30$, 43%), and inconsistent sentences ($M=1.18$, 39%) were least identified.

All of the two-way interactions (i.e., group by instruction, group by error type, and instruction by error type) were not significant . However, there was a tendency towards the three-way interaction of reader group by instruction by error type [$F(2,110)=2.32$, $p \leq .10$]. Visual comparison of the means of skilled readers in two instructional conditions with those of less skilled readers showed that instructions and problem types had somewhat different effects upon the two reader groups (see Figure 9-3). It appeared that, skilled readers, although they used the syntactic standard more often under the general instructional condition, were able to increase their use of the lexical standard and the semantic standard when specific instructions were given. In contrast, less skilled readers tended to use the lexical standard most frequently in both conditions, and their improvement in detecting errors was less substantial than that of skilled readers.

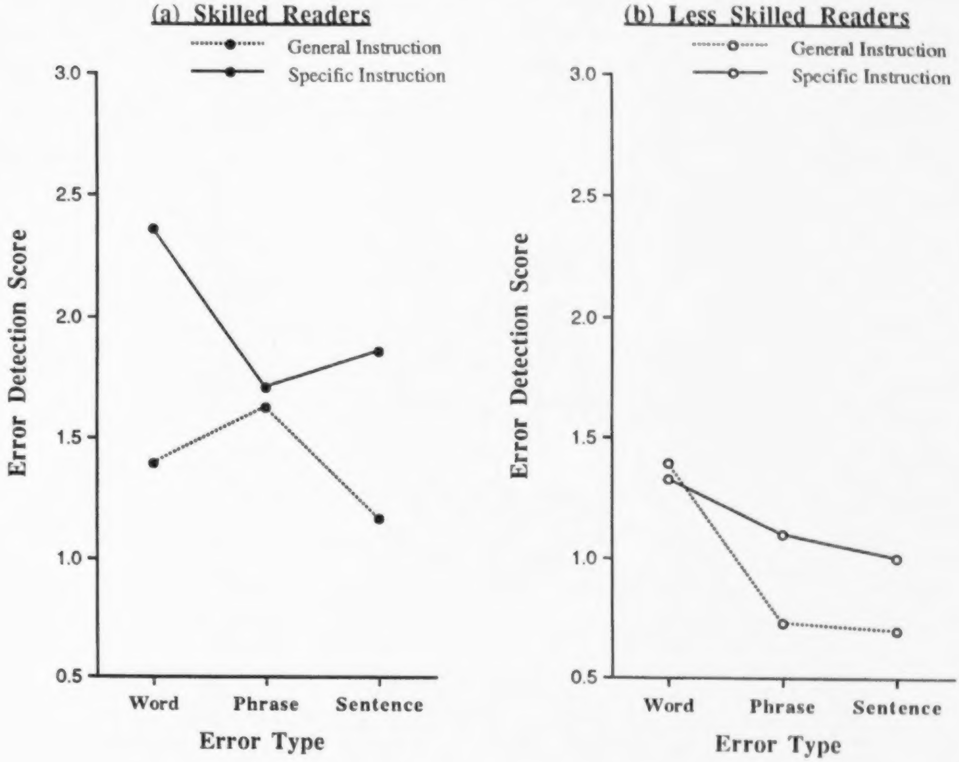
The results of error detection can be summarized as follows. First, overall skilled readers evaluated their comprehension more often than did less skilled readers. Second, specific instructions significantly improved comprehension monitoring performance. Finally, lexical standard was the most frequently used evaluation standard; less skilled readers relied heavily on this standard to evaluate comprehension in both instructional conditions, whereas skilled readers used this standard more often under specific instructions.

---

[3] In view that there were only three examples of each error type, attempts were undertaken to examine the extent of variability within each error type. The identification rate of each specific error was compared to the identification rates for other errors of the same type and different types. Although there was some variability, all of the nonsense words were identified in the highest range of probability (.49, .53, .57), with the identification rates of the nonsense phrases in the middle range (.41, .42, .46), and those of the inconsistent sentences in the lowest range (.33, 40, .43).

Figure 9-3

Mean Error Detection Scores within Group Comparisons



Reading times. While the above analyses showed that both reader groups evaluated their comprehension to a certain extent, their error detection performance was far from perfect. On average, the success rate of identifying all of the inserted errors was 56% for skilled readers and 34.8% for less skilled readers. However, as pointed out by several researchers (August et al., 1984; Baker, 1982; Zabrucky & Ratner, 1986), failure to report or identify errors does not necessarily indicate absence of comprehension monitoring. In this study, for those who did not explicitly identify (i.e., underline) the inserted errors, there was a possibility that they did detect problems at some level but not underline them. For example, they might spend more time on problematic text segments in an effort to resolve or verify the conflict . To test this possibility, reading times[4] of target statements for skilled and less skilled readers who did not underline the intended problems were examined.[5]

---

[4] As mentioned before, the computer automatically recorded the number and amount of time each time a statement was exposed on the screen. A single exposure time less than one second was treated as time for page flipping and discarded in calculating the number and total amount of reading times for each statement. The rationale for using one second as the cut-off point was based on the inspection of the overall data that average reading time for a statement without underlining was about three to four seconds.

Prior to analysis, four cases (all in the less skilled reader group) were identified as outliers because of their extremely long reading times on statements with nonsense words (one case) or with inconsistent information (three cases) (i.e., more than six standard deviations above the mean of the particular error type). These cases were deleted. The data were then subjected to a 2 (reader group) x 2 (instructional condition) x 3 (error type) repeated-measures analysis of variance with error type as a within-subject factor.[6] Table 9-6 presents the means and standard deviations of reading times as a function of group, instruction, and error type. None of the main effects of group and instruction, or the interaction effects was significant. On the other hand, the main effect of error type was significant [$F(2, 72) = 14.24$, $p \leq .0001$]. Multiple comparisons using the Tukey HSD procedure indicated that reading times for statements with nonsense phrases were significantly longer than those for statements with nonsense words (Tukey's HSD = 5.93, $p < .05$), and significantly longer than those for statements that contained inconsistent information (Tukey's HSD = 5.28, $p < .05$). This pattern of results seemed somewhat expected because reading statements with nonsense phrases required the subject to reconstruct the sentence structure and therefore extra reading time was needed. In contrast, reading statements with nonsense words did not involve sentence restructure. Similarly, reading statements with inconsistent information did not involve sentence restructure but required the subject to go back to preceding sentences to verify that something was inconsistent. That is, for statements with inconsistent information, the number of look-backs on preceding sentences rather than reading times for target statements would be a more accurate indication of comprehension monitoring. In brief, the main effect of error type seemed to suggest that, even for subjects who did not underline the intended errors, there was some indication of comprehension monitoring as they spent more time on statements with nonsense phrases. Skilled and less skilled readers, however, displayed similar comprehension monitoring patterns when intended errors were not explicitly identified.

---

[5] For target statements with underlined portions, exposure times would not reflect subjects' actual reading times because underlying took up a considerable amount of exposure times. As a result, exposure times of target statements with underlined portions were excluded for examination.

[6] It was recognized that error type was not truly a within-subject factor when some of the cases were deleted for analysis. However, the repeated-measures ANOVA, instead of three separate ANOVAs -- one for each error type, was chosen because it allowed us to examine the main effect of error type as well as interaction effects of error type with other factors.

Table 9-6
Means and Standard Deviations of Reading Times (sec.)
of Unidentified Target Statements.

Instruction	Group	Error Type	Case	M	SD
General	Skilled	Word	11	8.76	3.77
		Phrase	13	14.45	6.97
		Sentence	14	9.20	4.43
	Less Skilled	Word	13	8.11	3.97
		Phrase	14	17.13	9.81
		Sentence	12	10.93	4.99
Specific	Skilled	Word	7	7.89	7.73
		Phrase	9	15.06	12.83
		Sentence	9	9.48	7.50
	Less Skilled	Word	11	13.17	6.86
		Phrase	12	15.00	12.84
		Sentence	13	10.90	4.66

False identification The number of errors falsely identified constituted another on-line measure of the monitoring process. It has been shown that skilled readers correctly detected more errors than did less skilled readers. Was their better error identification performance simply a result of more claims of detected errors? That is, did skilled readers just underline more portions of the passages and thereby increased their chance of identifying the intended errors? To test this hypothesis, the total number of false identifications[7] across the six passages was calculated for each subject and the data were subjected to a 2 (reader group) x 2 (instructional condition) analysis of variance. The means of the false identification for the two groups under two instructional conditions are graphically depicted in Figure 9-4.

The main effect of reader group was significant [$F(1,55)=8.875$, $p \leq .004$]. However, it was the less skilled reader group who identified far more intact portions of the texts as problems ($M = 12.47$, $SD = 15.30$)than did the skilled reader group ($M = 3.55$. $SD = 5.65$). It is speculated that false identification of problems in non-problematic material was related to inappropriate standard use, and that less skilled readers more frequently applied inappropriate standards in evaluating their understanding. The fact that fewer false identifications occurred in the specific instructional condition (M = 6.0, SD = 10.24) than in the general instructional condition (M = 10.1, SD = 13.98) seemed to be consistent with this line of reasoning; however, the main effect of instructional condition was not statistically significant. The group by instruction interaction was also not significant.

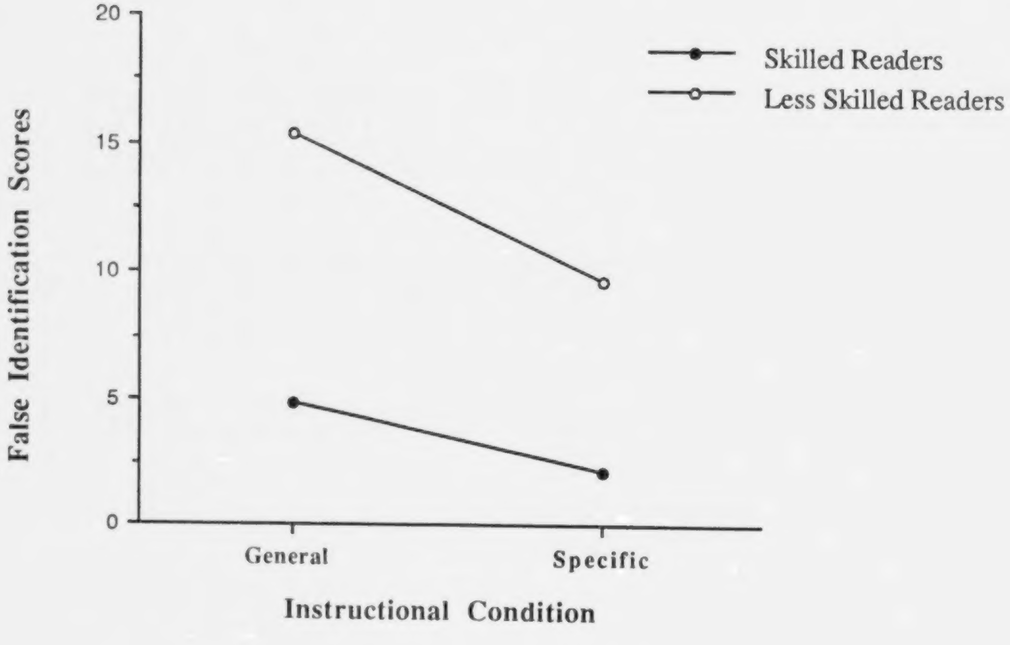
---

[7] False identifications referred to subjects' underlined portions of the intact text (i.e., text other than the inserted errors); one continuous underlined portion, whether it contained only one word or several words or one whole sentence, was recorded as one incidence of false identification.

Put together, although less skilled readers displayed a comprehension monitoring pattern similar to that of skilled readers when intended errors were not identified, they were unable to explicitly identify intended errors to a level similar to that of skilled readers. Moreover, they committed far more mistakes than did skilled readers. The findings of the on-line process measures thus provide more converging evidence that skilled readers were more efficient at evaluating their understanding.

Figure 9-4

False Identification Scores as a Function of Reader Group and Instructional Condition



Error detection, false identification, and comprehension performance. While the findings of the above analyses demonstrated that comprehension monitoring performance differentiated skilled readers from less skilled readers, the linkage between comprehension monitoring performance and comprehension performance remained unknown. To examine the relationship between comprehension monitoring and comprehension performance, Pearson's product-moment correlation coefficients were computed for the data on the two on-line comprehension monitoring measures (i.e., error detection sum scores and false identification sum scores from the six passages) and the comprehension performance measure (i.e., comprehension sum scores from the six passages). The correlation of the two on-line comprehension monitoring measures was not significant ($r=.04$, $p>.05$). On the other hand, error detection sum scores were positively correlated with comprehension sum scores ($r = 0.33$, $p<.01$), suggesting that better performance on the error detection measure was linked to better comprehension performance. A negative correlation ($r = -.41$, $p<.001$) was obtained between false identification sum scores and comprehension sum scores, demonstrating that fewer false identifications were associated with better comprehension performance. In short, results of the correlational analyses showed that there was a direct linkage between comprehension monitoring performance and comprehension performance.

Error insertion, instruction, and comprehension performance. The results of the error detection performance revealed a significant instruction effect indicating that higher error detection rates were observed in the specific instructional condition than in the general instructional condition. The instruction effect of the results of false identification performance, although not statistically significant, also reflected that fewer false identifications were obtained in the specific instructional condition. Did specific instructions, relative to general instructions, have a stronger effect on comprehension performance as well? Another area of concern was whether the insertion of errors would affect comprehension performance. To examine the effects of instructional condition and of error insertion on comprehension performance, the comprehension performance data were subjected to a 2 (reader group) x 2 (instructional condition) x 2 (passage type) repeated-measures analysis of variance with passage type as the within-subject factor. The passage type factor compared intact and error-inserted passages. The means and standard deviations of the comprehension mean scores for skilled and less skilled readers are presented in Table 9-7. Consistent with the t-test results reported earlier, a highly significant main effect of reader group was observed [$F(1, 55) = 64.40$, $p\leq.0001$]; skilled readers obtained significantly higher comprehension scores than did less skilled readers. The main effect of instructional condition was also significant [$F(1, 55) = 9.14$, $p\leq.004$]; both groups demonstrated better comprehension performance in the specific relative to the general instructional condition. The passage-type main effect was not significant [$F(1, 55) = 1.82$, p>.05], confirming the stipulation when designing materials that the error insertion procedures would not directly affect comprehension performance as measured by the multiple-choice comprehension questions of each passage. Neither the interactions of reader group with instructional condition and with passage type, nor instructional condition with passage type, reached significance. Taken together, the results of the several ANOVAs were consistent in demonstrating the effect of instruction upon comprehension monitoring performance and comprehension performance: specific instruction, relative to the general condition, increased correct error detection rates, lowered false identification rates, and led to better comprehension performance regardless of level of reading competence.

Table 9-7
Means and Standard Deviations of Comprehension Mean Scores as a Function of Group and Instruction

	Reader Group			
Instruction	Skilled Readers		Less Skilled Readers	
General	4.14	(0.41)	3.03	(0.35)
Specific	4.31	(0.35)	3.57	(0.61)
Overall	4.22	(0.38)	3.30	(0.56)

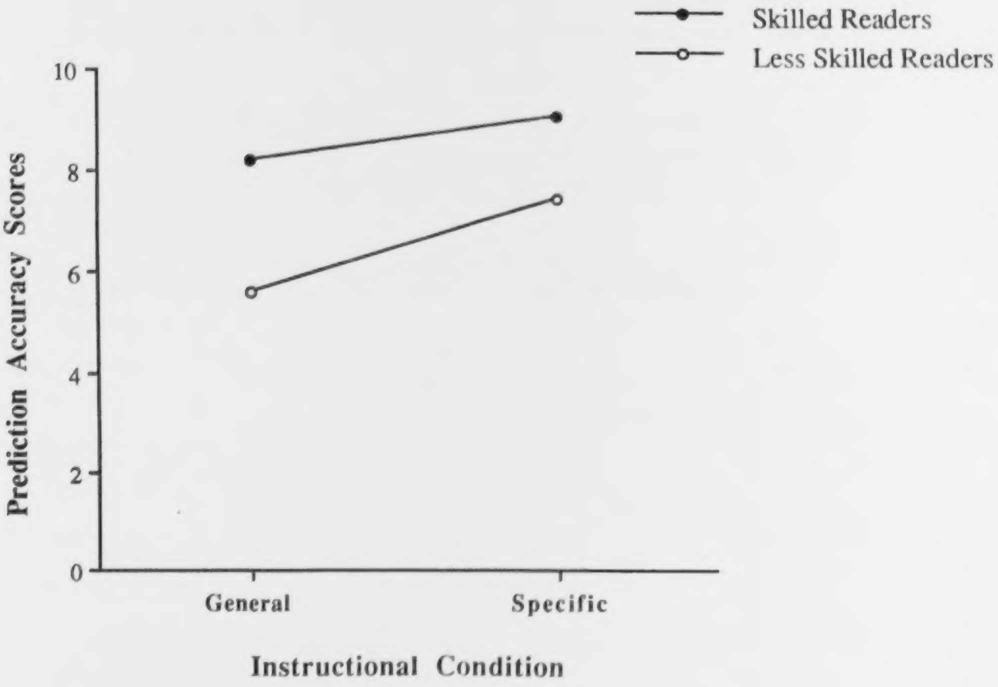
Note: The maximum mean comprehension score is 5.
Standard deviations are in parentheses.

Comprehension performance prediction In addition to error identification, subjects' estimate of their comprehension scores (i.e, how many questions out of five that they thought they had answered correctly for each passage) was another measure of the monitoring process but was an off-line measure (i.e., measured after students finished reading). If they were monitoring their comprehension and were aware of their degree of understanding, their prediction scores should be the same as or close to their performance scores. A scoring method was established to score subjects' accuracy of comprehension prediction. A score of two points was assigned if the reader's prediction score was exactly the same as his/her performance score on a passage. If the reader's prediction score was one point higher or lower than his/her performance score, a score of one point was given. If the reader's prediction score was two points or more higher or lower than his/her performance score, a score of zero was assigned. A sum score was computed for each subject by adding the prediction accuracy scores of six passages together. The data were subjected to a 2 (reader group) by 2 (instructional condition) analysis of variance with both factors as between-subject factors. Table 9-8 displays the means and standard deviations of the prediction accuracy sum scores for skilled and less skilled readers in two instructional conditions. The means are graphically depicted in Figure 9-5.

Table 9-8
Means and Standard Deviations of
Comprehension Prediction Accuracy Scores

Reader Group		Instructional Condition	
		General	Specific
Skilled Readers (N=29)	M	8.20	9.00
	SD	2.00	1.52
Less Skilled Readers (N=30)	M	5.60	7.40
	SD	1.77	1.81

Figure 9-5
Comprehension Prediction Accuracy Scores as a Function of
Reader Group and Instructional Condition



There was a highly significant main effect for group [F(1,55)=20.36, p<.0001], indicating that skilled readers were more accurate at predicting their comprehension performance than were less skilled readers. Since prediction accuracy is an indicator of comprehension monitoring, the result suggested that skilled readers were more aware of their degree of comprehension than were less skilled readers. A significant main effect of instructional condition was also obtained [F(1,55)=7.8, p≤.007]. Students who received specific instructions for error detection were more accurate at predicting their comprehension performance than those who received general instructions. The group by instruction interaction was not significant. It appeared that specific instructions not only led to higher error detection rates and comprehension performance as reported earlier but also had a significant impact on prediction of comprehension accuracy.

While the above results indicated that less skilled readers were less accurate at estimating their degree of comprehension, it was not known whether they tended to under-estimate or over-estimate their comprehension performance. To further examine the trends of estimate displayed by the two reader groups, frequency analysis of the agreements and disagreements between comprehension performance and comprehension prediction was carried out for each passage for each group.

Two methods were used to calculate agreements and disagreements. In method 1, accurate estimate was defined as absolute agreement between comprehension prediction and comprehension performance (i.e., one's actual comprehension score was 4 and his/her predicted comprehension score was also 4), over-estimate defined as predicted comprehension score one or more points higher than the actual comprehension score, and under-estimate as predicted comprehension score one or more points lower than the actual comprehension score. In method 2, in which a less stringent method was employed, accurate estimate was defined as predicted comprehension score within the +1 and -1 range of the actual comprehension score (i.e., when one's actual comprehension score was 4, his/her predicted score was counted as accurate if it was either 3, 4, or 5), over-estimate defined as two or more points higher than the actual comprehension score, and under-estimate as two or more points lower than the actual comprehension score. The results of the frequency analyses based on method 1 and method 2 are presented in Table 9-9 and Table 9-10 respectively.

Table 9-9

Percentage of Accurate Estimate (±0), Over-estimate (≥+1), and Under-estimate (≤-1) of Comprehension Performance (Method 1)

	Skilled Readers Estimate (%)			Less Skilled Readers Estimate (%)		
Passage	Over (>+1)	Accurate (+0)	Under (<-1)	Over (>+1)	Accurate (+0)	Under (<-1)
Bananas	48.3	41.4	10.3	63.4	23.3	13.3
Polar bears	13.8	62.1	24.1	16.7	40.0	43.3
Opera singers	10.3	62.1	27.6	40.0	50.0	10.0
Rodeo clown	41.4	41.4	17.2	56.7	20.0	23.3
Pottery	20.7	65.5	13.8	56.7	30.0	13.3
Penguins	34.5	37.9	27.6	46.7	30.0	23.3
Mean	28.2	51.7	20.1	46.7	32.2	21.1

Table 9-10

Percentage of Accurate Estimate (±1), Over-estimate (≥+2), and Under-estimate (≤-2) of Comprehension Performance (Method 2)

	Skilled Readers Estimate (%)			Less Skilled Readers Estimate (%)		
Passage	Over (≥+2)	Accurate (±1)	Under (≤-2)	Over (≥+2)	Accurate (±1)	Under (≤-2)
Bananas	10.3	89.7	0.0	26.7	73.7	0.0
Polar bears	0.0	93.1	6.9	10.0	90.0	0.0
Opera singers	0.0	96.6	3.4	16.7	76.7	6.7
Rodeo clown	6.9	86.2	6.9	13.3	86.7	0.0
Pottery	3.4	93.1	3.4	40.0	53.3	6.7
Penguins	3.4	89.6	6.9	23.3	73.3	3.3
Mean	4.0	91.4	4.6	21.6	75.6	2.8

It can be seen from Table 9-9 that, if method 1 was used, on average, 51.7% of skilled readers, compared to 32.2% of less skilled readers, accurately predicted their comprehension performance. The percentage of accurate estimate increased to 91.4% for skilled readers and 75.6% for less skilled readers if method 2 was employed (see Table 9-10). In other words, skilled readers were more accurate at predicting their comprehension performance, indicating that they were more aware of their degree of understanding. More striking, however, was the contrast of the percentage of over-estimate between skilled and less skilled readers. According to method 1, 28.2 % of skilled reader versus 46.7 % of less skilled readers over-estimated their comprehension performance by one or more points. When method 2 was used, only 4% (1/25) of skilled readers but 21.6% (more than 1/5) of less skilled readers estimated their comprehension scores at least two points higher than their actual performance.

In brief, analyses of the comprehension prediction data revealed that less skilled readers, compared to skilled readers, seemed to be less aware of their degree of understanding and were more inclined to over-estimate their comprehension performance.

Taken together, on-line and off-line measures of the comprehension monitoring process consistently pointed to the findings that skilled readers, in comparison to less skilled readers, were more efficient in evaluating their comprehension, as evidenced by their higher error detection rates, fewer false identifications, and more accurate comprehension performance predictions.

9.2.3 Analyses of Monitoring Strategies (Regulations)

Results of the previous section demonstrated that skilled readers were more successful at detecting comprehension problems than were less skilled readers. A question that follows is whether skilled readers were also more successful at using strategies to fix up comprehension problems once the problems were detected. Of particular interest here was subjects' use of look-backs[8] to resolve comprehension problems. Were skilled and less skilled readers different in employing the rereading strategy to regulate their comprehension? Subjects' use of look-backs was analyzed in terms of look-backs for intact passages and error inserted passages, look-backs for target statements that contained inserted errors (i.e., nonsense words, nonsense phrases, or inconsistent sentences), and look-backs for context sentences that contained information making target sentences inconsistent.

Look-backs for passages. Did subjects use the rereading strategy more often when they read error-inserted passages than when they read intact passages? A 2 (reader group) x 2 (instructional condition) x 2 (passage type) analysis of variance with the last factor repeated was conducted on data of look-backs. Table 9-11 displays the means and standard deviations of look-backs as a function of group, instruction and passage type. As expected, a reliable main effect of passage type was obtained [$F(1,55) = 4.99$, $p \leq .03$]; significantly more look-backs occurred in error-inserted passages than in intact passages. The main effect of group was not significant, even though skilled readers (M = 0.33, SD = 0.27) appeared to reread more often than did less skilled readers (M = 0.24, SD = 0.26). The main effect of instruction and all interaction effects were also not significant.

---

[8] As mentioned in the method section, the computer automatically recorded the amount of time and each time a statement was exposed on the screen. Look-backs for each statement were defined as the number of times subjects initiated additional exposures of the statement after their first exposure to it. It should be noted, as explained in the reading times section, that a single exposure time less than one second was treated as time for page flipping and discarded in calculating the number of look-backs.

Table 9-11

Means and Standard Deviations of Passage Look-backs

		Passage Type			
Instruction	Group	Error-inserted		Intact	
General	Skilled	0.38	(0.39)	0.28	(0.32)
	Less Skilled	0.27	(0.35)	0.21	(0.32)
Specific	Skilled	0.42	(0.32)	0.26	(0.18)
	Less Skilled	0.25	(0.30)	0.22	(0.25)

Note: Standard deviations are in parentheses.

Look-backs for target statements. Analysis of overall passage reinspection showed that skilled readers were not significantly different from less skilled readers. But were they different in regulating their comprehension when specific problems arose? That is, were skilled readers more likely to go back to the target statement when it contained an inserted error than were less skilled readers? To examine this possibility, the means of look-backs for target statements for each group were calculated and the data were subjected to a 2 (reader group) x 2 (instructional condition) x 3 (error type) analysis of variance with the last factor as a within-subject factor. The means and standard deviations of the means of look-backs for target statements for the two groups are presented in Table 9-12.

The ANOVA for the three types of target statements failed to produce any significant effects. The results were not surprising, since it has been argued in the previous section on reading times that among the three type of problems, inconsistency is the only type of problem that would require the reader to look for information beyond the sentence level, and compare previous information with latter information in order to resolve the inconsistency. For nonsense words (i.e., lexical problems) and, particularly, nonsense phrases (i.e., syntactic problems), rereading would typically occur within the sentence level, as indicated by longer reading times reported in the earlier section. In other words, look-backs beyond the sentence level would most likely occur when encountering inconsistent information. To examine this possibility, a 2 (reader group) x 2 (instructional condition) analysis of variance was performed on the data of look-backs for target sentences that contained inconsistent information. The analysis, however, failed to obtain any significant effects. Although skilled readers were observed to have more look-backs (M = 0.41) than did less skilled readers (M = 0.28), the difference did not reach significance. This result was somewhat unexpected. However, since resolving inconsistency would require the reader to go back to preceding sentences to verify that something was wrong, it was speculated that look-backs on preceding context sentences that contained information making target sentences appear contradictory would be a more critical indicator of comprehension monitoring. In other words, it was hypothesized that look-backs would occur primarily to context statements -- statements with key information making target sentences inconsistent.

Table 9-12

Means and Standard Deviations of Look-backs for Target Statements

	Group			
Type of Target	Skilled Readers		Less Skilled Readers	
Nonsense word	0.33	(0.41)	0.29	(0.40)
Nonsense phrase	0.38	(0.44)	0.29	(0.40)
Inconsistency	0.41	(0.41)	0.28	(0.35)

Note: Standard deviations are in parentheses.

Look-backs for context statements. A 2 (reader group) x 2 (instructional condition) analysis of variance was performed on the data of look-backs for context sentences. As predicted, it was on this aspect that skilled readers distinguished themselves from less skilled readers [$F(1,55) = 5.08, p \leq .028$], demonstrating significantly more look-backs than their counterparts in searching for relevant information to resolve inconsistency. The means of look-backs for context statements were 0.6 (SD = 0.51) for skilled readers, and 0.3 (SD = 0.48) for less skilled readers. The instruction and interaction effects were not significant.

To summarize, no significant differences were found between skilled readers and less skilled readers in terms of overall passage look-backs and of look-backs for error-inserted statements. However, skilled readers reexamined context statements significantly more often than did less skilled readers. The pattern of results seemed to support the notion of skilled readers as strategic readers who use the rereading strategy flexibly in that they know when (i.e., when comprehension problems cue access to previous text) and where (i.e., the relevant segment of text) to apply the strategy (Garner, 1992).

9.2.4 Analyses of Motivational Beliefs (Attributions)

Results of the foregoing two sections demonstrated that skilled readers were more efficient than less skilled readers in evaluating their degree of comprehension, and were more strategic in regulating their comprehension . Were the two groups' observed differences in comprehension monitoring activities (i.e., evaluations and regulations) related to their perceived causes of comprehension outcomes? To examine this possibility, subjects' attributions to four specific causes (i.e., effort, ability, task difficulty, and luck) of comprehension outcomes were analyzed.

For scoring, one point was given to the subject's attribution to each specific causal category and then, for each subject, total attributions for each category were summed, separately for success and for failure outcomes. The scores of the four specific causes were analyzed in separate analyses of variance with group (skilled, less skilled) and instructional condition (general, specific) as between-subjects factors, and outcome (success, failure) as a within-subjects factor.[9] Previous analyses have shown that instructional conditions had significant influences upon subjects' comprehension monitoring and comprehension performance. This factor, therefore, was included in the present analyses to examine the possible impacts of different instructions upon readers' causal attributions.

Attributions to effort The ANOVA yielded a significant main effect of outcome for effort scores [F(1,55) = 28.51, $p \leq .0001$]. Nevertheless, this main effect was qualified by the significant interaction between group and outcome [F(1,55) = 4.13, $p \leq .05$]. The use of Tukey's HSD as a follow-up procedure revealed no significant differences in the effort scores of skilled readers for success (M = 1.34) and for failure (M = 0.76). Less skilled readers, however, had significantly higher effort scores for success (M=1.77) than for failure (M= 0.47). This pattern of results suggested that less skilled readers judged effort as significantly more important in determining success than they judged lack of effort in determining failure. Since effort is usually viewed as an internal and controllable factor (Weiner, 1979), this finding indicated that less skilled readers tended to believe that failures are relatively uncontrollable. The group by outcome interaction of effort scores is depicted in Figure 9-6a.

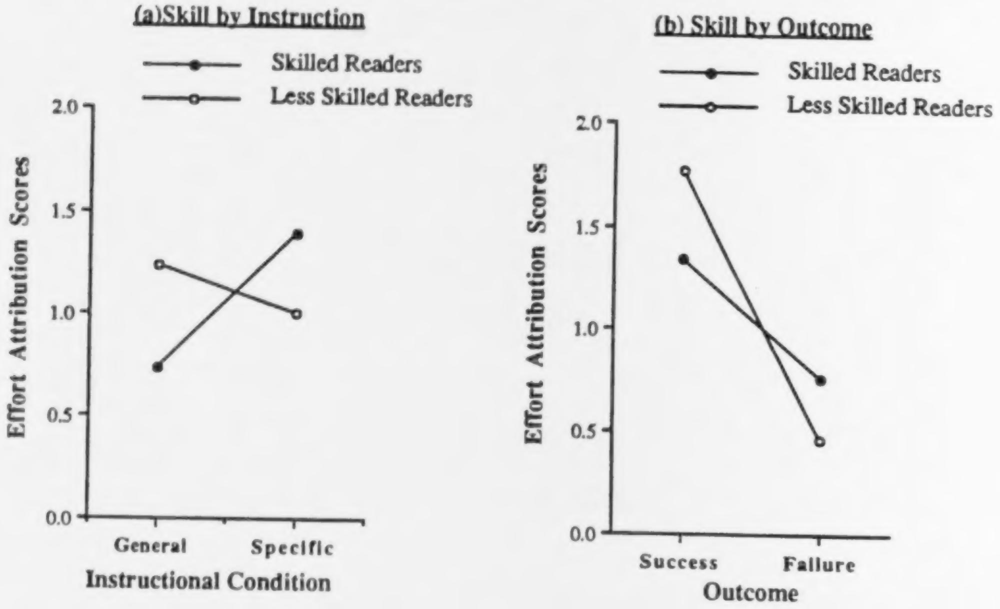
Of more interest was the significant group by instruction interaction [F(1,55) = 4.69, $p \leq .03$]. Inspections of the means involved in this interaction revealed that skilled readers had higher effort scores in the specific instructional condition (M = 1.39) than in the general instructional condition (M = 0.73). In contrast, less skilled readers viewed effort as a greater cause of outcomes in the general condition (M = 1.23) than in the specific condition (M = 1.00). It appeared that, in terms of effort attributions, the impacts of general and specific instructions were judged differently by the two reader groups. The group by instruction interaction of effort scores is illustrated in Figure 9-6b.

---

[9] The subjects were asked to attribute comprehension outcomes to one of the four specific causes presented to them on six occasions. On three of these occasions, comprehension outcomes were manipulated as successes and the other three as failures. The scoring system basically reflected frequency distributions of the four causal categories. It was recognized that examination of the scores of the four categories within one analysis of variance would not be appropriate because the effects of skill and outcomes would turn out to be zero due to equal distributions of scores for these two factors. Therefore, four separate ANOVAs were carried out, one for each causal category. The ANOVAs, rather than chi square statistics, were the choice for analyses because interaction effects among factors could be examined.

Figure 9-6

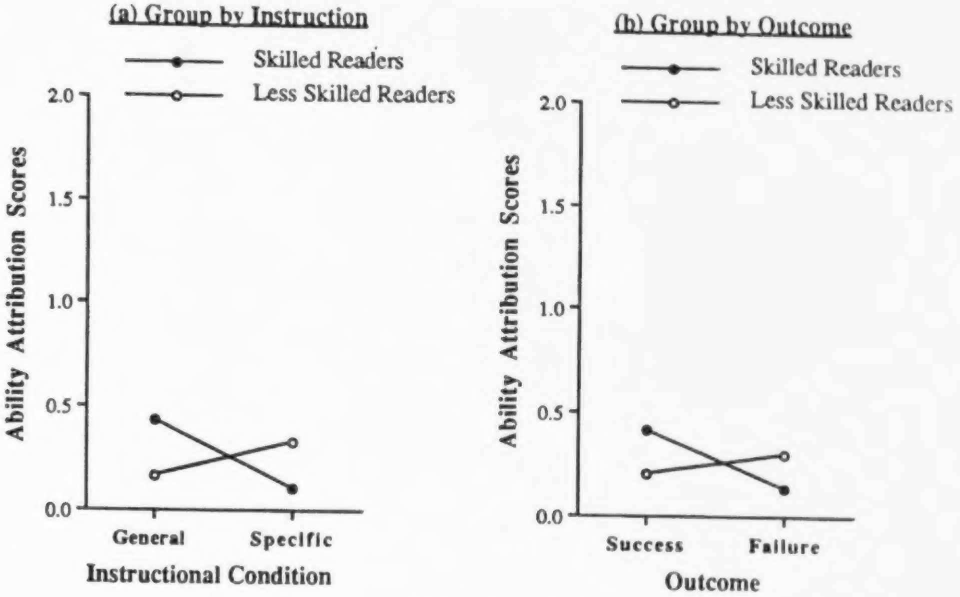
Skilled and Less Skilled Readers' Effort Attributions



Attributions to ability The ANOVA on ability scores failed to produce any significant effects, although trends ($p < .1$) for group by instruction and group by outcome interactions occurred. For the group by instruction interaction, skilled readers attributed greater importance to ability for outcomes in the general instructional condition (M = .43) than in the specific instructional condition (M = .11), but less skilled readers attributed less importance to ability for outcomes in the general instructional condition (M = .17) than in the specific instructional condition (M = .33). With regard to the group by outcome interaction, skilled readers had higher ability scores for success (M = .41) than for failure outcomes (M = 0.13), while less skilled readers had slightly lower ability scores for success (M = 0.20) than for failure outcomes (M = 0.30). The group by instruction and group by outcome interactions of ability scores are depicted in Figure 9-7a and Figure 9-7b, respectively.

Figure 9-7

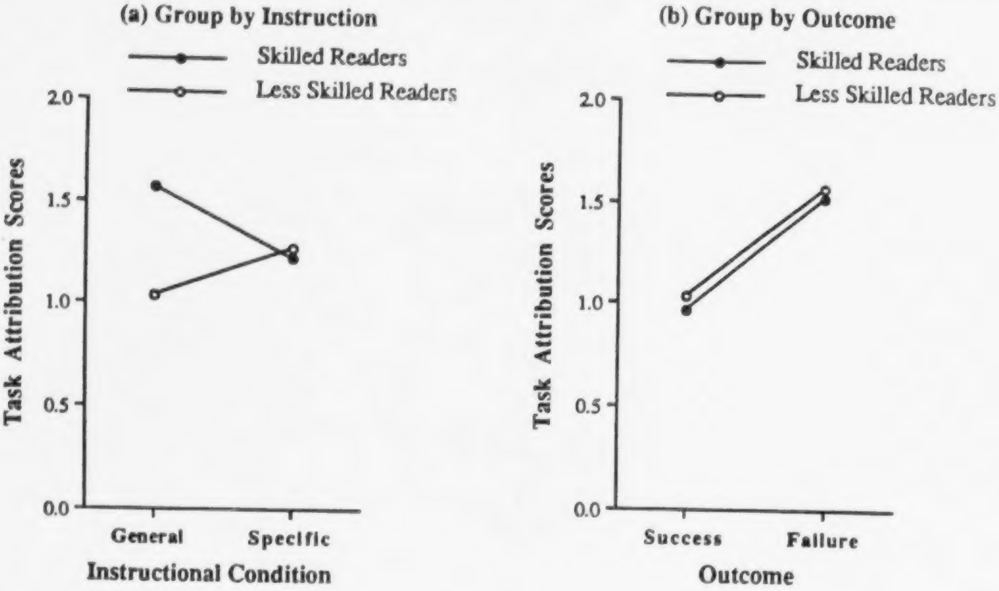
Skilled and Less Skilled Readers' Ability Attributions



Attributions to task difficulty The main effect of outcome [F(1,55) = 7.19, p≤ .001] was the only significant effect obtained from the ANOVA on task difficulty scores, indicating that task difficulty was viewed as more important for failure than task ease for success. Although the interactions between group and instruction and between group and outcome were not significant, for the purposes of comparing the four causal categories, these interactions are depicted in Figure 9-8a and Figure 9-8b, respectively. It is interesting to note that skilled and less skilled readers, again, appeared to display a different pattern of causal attributions under the two instructional conditions. Similar to the one observed for ability attributions, skilled readers attributed outcomes to task ease or difficulty more often under general instructions (M = 1.57) than under specific instructions (M=1.21), whereas less skilled readers judged task ease or difficulty as a cause for outcomes less often under general instructions (M = 1.03) than under specific instructions (M = 1.27). However, the trend for group by outcome interaction of ability attributions was not observed for task attributions; both groups considered task difficulty to be a more important factor of their failures than task ease as a factor of their successes.

Figure 9-8

Skilled and Less Skilled Readers' Task Difficulty Attributions



Attributions to luck Similar to the ANOVA results of task attributions, the only significant effect obtained from the ANOVA on luck attribution scores was outcome [F(1,55) = 13.52, $p \leq .001$]. Inspections of the means suggested that both groups considered lack of luck to be more important for failure than luck for success. All other main or interaction effects were not significant. For comparison purposes, the interactions between group and instruction and between group and outcome are illustrated in Figure 9-9a and Figure 9-9b, respectively.

Comparing the four causal attributions While the above analyses revealed some specific patterns of attributions for each causal category, comparisons of subjects' causal attributions across the four causal categories provides a clearer picture of the attributional preferences in the two reader groups. The means and standard deviations of subjects' attribution scores for the four categories as a function of reader group, instructional condition, and outcome are presented in Table 9-13.

Figure 9-9

Skilled and Less Skilled Readers' Luck Attributions

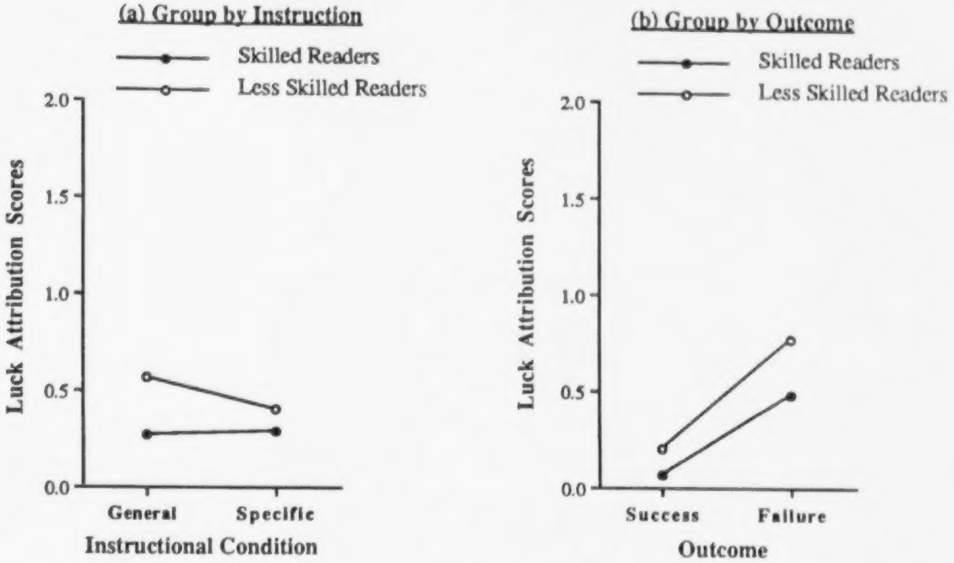


Table 9-13

Means and Standard Deviations of Causal Attribution Scores

			Cause			
Group	Instruction	Outcome	Effort	Ability	Task	Luck
Skilled	General	Success	1.07	0.60	1.27	0.07
			(1.10)	(0.98)	(1.16)	(0.26)
		Failure	0.40	0.27	1.87	0.47
			(0.91)	(0.56)	(1.13)	(0.74)
	Specific	Success	1.64	0.21	1.07	0.07
			(1.39)	(0.58)	(1.38)	(0.27)
		Failure	1.14	0.00	1.36	0.50
			(1.29)	(0.00)	(1.28)	(1.09)
Less Skilled	General	Success	1.93	0.13	0.80	0.13
			(0.88)	(0.52)	(0.86)	(0.35)
		Failure	0.53	0.20	1.27	1.00
			(0.83)	(0.59)	(0.96)	(1.07)
	Specific	Success	1.60	0.27	0.87	0.27
			(0.98)	(0.80)	(0.99)	(0.59)
		Failure	0.40	0.41	1.67	0.53
			(0.83)	(0.83)	(1.23)	(0.92)

Note: The maximum scores of the four causes added together for each group under each instructional condition for each type of outcome was 3. In other words, each score in the table reflects the proportion of total attributions made in each causal category by each of the reader groups as a function of outcome and instructional condition.

As can be seen in Table 9-13, although there was some variation in attributions under the two instructional conditions, overall, effort and task difficulty were the two causes subjects most frequently ascribed to outcomes; proportions of ability and luck attributions were relatively small. It is speculated that the effect of instructions was the major reason contributing to the large proportions of effort and task attributions. The interactive effects of instructions upon reader groups and outcomes revealed in the ANOVAs for individual categories presented earlier seemed to be in line with this reasoning. Analyses of subjects' shifts of attributional patterns for different outcomes under different instructions afforded further evidence for this speculation.

For skilled readers, when they were given general instructions to understand the passages and identify problems (i.e., types of problems unspecified and no examples provided) in the passages, they considered task ease or difficulty to be the most important factor for their successful or unsuccessful comprehension (M's = 1.27 and 1.87, respectively). In contrast, when they were given specific instructions to understand the passages and identify problems (i.e., three types of problems specified and examples provided) in the passages, they judged effort or lack of effort as the major reason for their comprehension successes and failures (M's = 1.64 and 1.14, respectively). Task ease or difficulty still played an important role, but not as much as they did under general instructions. It is argued that when instructions were specific, skilled readers were more able to adjust their degree of effort to meet the specific task demands and therefore might have felt that they were more in control of the outcomes of the criterion task. Consequently, they attributed their performance more frequently to their effort or lack of effort. However, when instructions were general, skilled readers were less able to adjust their degree of effort because they did not have specific criteria to judge whether or not the task demands had been fulfilled satisfactorily; they might feel less in control of their performance outcomes. As a result, they tended to attribute outcomes, particularly failure outcomes, more often to the task factor in the general instructional condition. It was recognized that general and specific instructions were directed to the evaluation aspect of comprehension (i.e., identification of inserted problems) and might not be necessarily related to comprehension performance (i.e., answering comprehension questions) by subjects. The effect of instructions upon skilled readers' attributions of comprehension performance outcomes indicated that skilled readers linked comprehension monitoring performance to comprehension performance; they attributed their comprehension outcomes more often to effort when they were able to evaluate their comprehension using specific standards provided by specific instructions.

On the other hand, the two types of instructions appeared to have similar impacts upon less skilled readers' attributions for successful outcomes. In general as well as in specific instructional conditions, less skilled readers viewed effort as the most important factor (M's = 1.93 and 1.60, respectively) for their success. However, task difficulty became the most prominent cause that less skilled readers ascribed to failure. This trend was more evident in the specific instructional condition (M = 1.67) than in the general instructional condition (M = 1.27). It is speculated that different instructions did not lead to different patterns of effort and task attributions in successful outcomes for less skilled readers, as they did for skilled readers, because less skilled readers were less aware of the different task demands brought about upon comprehension monitoring by the two types of instructions, and were less able to link comprehension monitoring to comprehension performance. As a result, patterns of effort attributions were similar under both instructions; less skilled readers credited themselves in terms of effort, regardless of different task demands for comprehension monitoring, for successful comprehension. With respect to attributions to failure outcomes, less skilled readers considered task difficulty the most important factor, particularly when they were given specific instructions. It is possible that less skilled readers, when instructed to understand the passages as well as to use specific standards to identify problems, might have felt that they were less able to control performance outcomes because they were overwhelmed by the complex task demands -- to identify specific problems on the one hand and understand the passages on the other. Therefore, when they were asked to attribute comprehension failures to one of the four causes, task difficulty apparently became the dominant cause.

In other words, while controllability of outcomes was a function of effort and task factors, it had different implications for skilled and less skilled readers. Skilled readers perceived outcomes as more controllable when task demands were specific and adjusted their attributions of effort and task accordingly. For less skilled readers, it was a different attributional process. They viewed successful outcomes only as more controllable regardless of task demands, and attributed failures most frequently to task difficulty when task demands were specific.

Although proportions of ability and luck attributions were relatively small for both reader groups, further comparisons of the two groups' shifts of attributions across situations revealed some interesting patterns. As indicated in Table 9-14, the proportion of skilled readers' attributions to ability, in comparison to their attributional patterns for this category under other situations, was particularly high under general instructions for success (M = 0.6), and were extremely low under specific instructions for failure outcomes (M=0). It is possible that skilled readers considered themselves "smart" if they were able to perform successfully even without specific guidances. Furthermore, skilled readers' total rejection of lack of ability as a reason for failure outcomes under specific instructions indicated that they viewed themselves as highly competent in meeting specific task demands; their failures were due to reasons other than lack of ability. Overall, skilled readers seemed to shift their ability and task attributions more towards effort attributions when specific instructions were given. It is argued that this pattern of changes in attributions was an indication of skilled readers' flexibility in adjusting their degree of effort (at least in their own perceptions) in response to different task demands. Skilled readers' attributions of luck, however, appeared to be affected only by types of outcomes, but not by types of instructions. In particular, their attributions to luck for successful outcomes were extremely rare (M's = 0.07). Their reluctance to ascribe success to pure luck indicated that they did not believe that success is determined by chance.

With regard to less skilled readers' ability and luck attributions, it was observed that their highest ability attributions were made under specific instructions for failure outcomes (M = 0.41, while skilled readers' corresponding M = 0). This may be an indication of less skilled readers' perceptions of lack of competence in meeting specific task demands. It is suggested that this particular observation, put together with the trends for group by instruction and group by outcome interactions observed in the ANOVA results for ability scores, pointed to a possibility of a lower self-concept of ability in less skilled readers. Furthermore, while skilled readers' luck attributions, as mentioned earlier, appeared not to be affected by instruction, it was noted that less skilled readers' luck attributions were particularly high for failure under general instructions (M = 1.0). It is possible that general instructions might give less skilled readers an impression that the tasks were relatively easy.[10] Therefore, when they were asked to explain their failure outcomes in face of easy tasks, lack of luck became an apparent choice.

In short, the results of the ANOVAs as well as the above analyses revealed the complex relationships among attributions, reader skills, performance outcomes, and instructions. The interactive nature of attributions with other variables indicated the importance of investigating attributions with consideration of the effects of contextual factors (e.g., persons, tasks, instructions, and outcomes).

---

[10] It should be noted that, in previous analyses, skilled readers appeared to view their tasks as more difficult under general instructions, probably because they did not have specific criteria to judge whether or not the task demands had been met satisfactorily.

9.3. General Discussion

This study examined skilled and less skilled readers' comprehension monitoring processes, strategies, and attributions using a number of different measures. In the following sections, major findings from the study are highlighted, issues related to the error detection research paradigm are discussed, and directions for future inquiries are suggested.

9.3.1 Research Findings Synthesized

The results of this study by and large corroborate the findings of previous comprehension monitoring research in that the differences between skilled and less skilled readers in evaluations and regulations of comprehension were evident even after the effects of background knowledge and passage reading levels were experimentally controlled. The present data are notable because multiple measures were employed, and the link between comprehension monitoring and comprehension performance was directly examined, thereby providing more convergent evidence supporting a substantial relationship between comprehension monitoring and comprehension performance.

Evaluations. With respect to comprehension monitoring processes, that is, the evaluation aspect of monitoring, skilled readers, in comparison to less skilled readers, identified more inserted errors, committed far fewer identification mistakes, and predicted their comprehension performance more accurately. All these findings point to a higher level of comprehension evaluation skills in skilled readers. Specifically, skilled readers' pattern of error identification indicates that they were more effective in using multiple standards to evaluate their comprehension. Less skilled readers, in contrast, appeared to rely more often on the lexical standard to evaluate their comprehension, reflecting a basic concern with the understanding of individual word meanings. These findings are in line with the results of previous studies (e.g., Baker, 1984; Garner, 1981; Zabrucky & Moore, 1989) and those of Study 1, in which subjects' perceived goals and metacognitive knowledge of reading was investigated, that less skilled readers tended to maintain a decoding orientation towards reading. Furthermore, less skilled readers were inferior to skilled readers in detecting syntactic errors, a finding consistent with Bowley's (1986) demonstration of limited awareness of grammatical well formedness in poor readers. More importantly, less skilled readers were less able than skilled readers to detect internal inconsistencies presented in the passages, indicating their relative failure to monitor their comprehension at the semantic level. Some researchers have argued that readers' ability to utilize contextual information in text is primarily related to working memory capacity (e.g., Kirby & Moore, 1987;

Haenggi, & Perfetti, 1992; Vosniadou, Pearson, & Rogers, 1988). In particular, Vosniadou and her associates (1988) pointed out that failures to detect inconsistencies may be due to incomplete recall of the inconsistent information rather than to difficulty in comparing the inconsistent propositions. It is recognized that differences between skilled and less skilled readers' performance on inconsistency detection may, in part, be due to differences in working memory resources. However, the differences of overall error detection performance between the two reader groups in the present study cannot be explained solely in terms of working memory difficulties because less skilled readers were also found to be inferior in detecting syntactic errors where recall of previously presented information was not involved. Hence, it is argued that the results of the present study indicate that less skilled readers, in comparison to skilled readers, were less able in employing syntactic and semantic standards to monitor their comprehension.

Another major finding of the evaluation aspect of comprehension monitoring is that skilled readers were better at estimating comprehension accuracy than less skilled readers. In particular, less skilled readers tended to over-estimate their comprehension performance, indicating that they were not aware that they answered some of the questions incorrectly. This pattern of results suggests a lack of comprehension awareness in less skilled readers, or in Glenberg, Wilkinson, and Epstein's (1982) term, "an illusion of knowing". It is suspected that, over time, less skilled readers' repeated experiences with "delusion of knowing" (i.e., actual comprehension performance lower than expected comprehension performance) may generate increasingly negative attitudes towards reading which may lead to even poorer reading performance (Johnston & Winograd, 1985). The interactive nature of metacognitive and motivational aspects of reading will further be discussed in the summary section when the results of this study are are put together.

In addition, the consistently strong effect of instructional conditions upon readers' various aspects of performance should be noted. For example, both groups had lower false identification rates, higher comprehension performance scores and higher comprehension prediction accuracy scores under specific instructions. It is plausible that instructions directed to use of specific evaluation standards increased readers' overall level of comprehension awareness and thereby led to higher comprehension performance and prediction accuracy. It is in this sense that the results are encouraging in suggesting that even less skilled readers can be taught to increase their comprehension awareness and comprehension performance with minimal intervention (i.e., provision of specific evaluation standards and examples). Effective and flexible use of multiple standards for critical comprehension evaluation may, however, require more intensive and comprehensive interventions. It should be pointed out that, while both groups were responsive to specific instructions in applying multiple standards to identify errors, the magnitude of improvement between instructional conditions was much greater for skilled readers. Similar findings with respect to specific instructions were also reported in other studies with children (e.g., Baker, 1984; Zabruck & Moore, 1989) or with adults (Baker, 1985a; Zabrucky, 1990). It appears that less skilled readers' difficulty in evaluating their understanding is not simply due to not knowing *what* standards to apply but also due to not knowing *how* to apply the standards. The results of the present study thus suggest that interventions aiming at improving less skilled readers' effective and flexible use of multiple standards for critical comprehension evaluation involve more than simply providing different standards and examples. Issues related to interventions will be further discussed in a later section.

Regulations. The use of the rereading strategy was the central focus of the regulation aspect of comprehension monitoring in this study. Overall, skilled readers did not significantly differ from less skilled readers in terms of the number of rereadings for passages and for error-inserted statements. However, it was on the aspect of look-backs for context statements, statements containing information which made target statements inconsistent, that skilled readers distinguished themselves from less skilled readers. Skilled readers reexamined context statements significantly more often than did less skilled readers. This pattern of results is consistent with the notion of skilled readers as strategic readers who use strategies in an effective and economical fashion (Garner, 1992; Mulcahy, 1991; Paris, Wasik, & Turner, 1992). Furthermore, when taken together with the interview data from Study 1 indicating skilled readers' metacognitive awareness of planning and flexible strategy use, these results point to the importance of investigating strategy use in the context of settings. In fact, Garner (1990) has suggested that research on strategy use should be grounded in a theory of settings, mainly because of the context-dependent characteristic of strategy use. "One thing we already know about strategy use is that it is embedded," argues Garner (1990). "It does not occur in a vacuum. When context varies, the nature of strategic activity often varies as well" (p. 523). In this study, skilled readers' selective rereading in response to the necessity of situations (i.e., when comprehension problems initiate the need to reread, and only to the relevant segment of text) clearly supports Garner's argument for the need of strategy research invested in a variety of settings.

Attributions. Similar to the above results of strategy use pointing to the importance of settings, the analyses of skilled and less skilled readers' attributional beliefs reveal the dependency of attributions on contextual factors such as outcomes and instructions. This dependency was demonstrated in the separate ANOVAs for the four causal attributions and in the subsequent examinations of the patterns of attributions across the four causal attributions for the two reader groups. For skilled readers, there were some indications that they linked comprehension monitoring to comprehension performance in that they attributed comprehension outcomes more often to effort when they were able to evaluate their degree of comprehension using specific standards provided by specific instructions. In contrast, less skilled readers appeared to be less able to link comprehension monitoring to comprehension performance in that they attributed success most often to effort and failure to task difficulty, disregarding the different task demands brought about by different instructions.

The attributions made by skilled readers and less skilled readers in this study differed in a number of respects from those reported in previous studies. First, unlike the poor readers in other studies who were less likely to see themselves as personally responsible for their success (e.g., Butkowsky & Willows, 1980; Pearl, Bryan, & Donahue, 1980), less skilled readers in this study demonstrated the normal attribution pattern labelled "self-serving effect" revealed in the attribution literature: the tendency to attribute success to internal causes such as effort and failure to external causes such as task difficulty and luck (Marsh, 1986). Another intriguing difference between the results of this study and those of the Butkowsky and Willows (1980) study is that effort and task were two major causes both skilled and less skilled readers ascribed to outcomes. In Butkowsky and Willows' study, the ease of task was less often viewed by good readers as a reason of success. Finally, although a lower self-concept of ability in less skilled readers was suggestive in this study, the proportion of ability attribution was too small to make a strong claim like those made in other studies (e.g., Butkowsky & Willows, 1980; Marsh, Cairns, Relich, Barnes, & Debus, 1984).

There are several factors that may account for the above different findings. First, differences in findings between this study and previous investigations may be due, in part, to differences in instruments. Many of the studies (e.g., Marsh et al., 1984; Pearl et al., 1980) relied on attribution questionnaires in which children's attributions about hypothetical tasks and people are assessed. In this study, a task-specific measure was employed; attributions were solicited after subjects finished their comprehension passages. Although the Butkowsky and Willow (1980) study also used a task-specific measure, the anagram tasks that they employed did not represent normal reading tasks that students usually encounter in daily life or school settings. More importantly, the effects of instructions have not been examined in previous studies. In this study, instructions, general or specific, directing students' attention to task demands (i.e., comprehension monitoring and understanding), might have increased students' metacognitive awareness of reading goals and their goal-directed reading behaviors. It is therefore not surprising that they attributed their outcomes more often to effort and task factors. Since both groups focused their attention to task demands, their relatively less concern about ability attributions might be expected.

On the other hand, the attributional pattern displayed by less skilled readers in this study seems to provide qualified support for the observations of "learned helplessness" in poor readers revealed in the literature (see Johnston & Winograd, 1985; and Winograd & Niquette, 1988, for reviews of this literature). Learned helplessness, a term originated as an explanation for adult depression, refers to one's perception of being helpless to control events (Winograd & Niquette, 1988). According to Winograd and Niquette (1988), poor readers experience difficulty perceiving the relationship between their effort and academic outcomes, and often attribute their difficulties to their own low ability. In this study, less skilled readers believed effort was an important reason for success, but they were less likely to ascribe lack of effort as a cause for failure. This finding suggests that less skilled readers appeared to believe that effort is relatively useless in the face of failure. In other words, less skilled readers did perceive an independence between effort and outcome in the manner suggested by Winograd and Niquette (1988), but only for failure outcomes. Moreover, the results of this study revealed a trend suggesting that less skilled readers, particularly when they were asked to meet specific task demands, tended to attribute their failures more often to a lack of ability than did skilled readers. This observed difference, however, did not reach statistical significance. Thus, the results of this study offer only partial support for the presence of learned helplessness in poor readers as suggested by other researchers (e.g., Butkowsky & Willows, 1980; Winograd & Niquette, 1988).

Summary. Put together, the findings of this study demonstrate the metacognitive and motivational differences between skilled and less skilled readers. In the metacognitive area, skilled readers, in comparison to less skilled readers, demonstrated relatively effective use of multiple standards, and regulated their comprehension in a more strategic manner. In the motivational area, skilled readers appeared to attribute comprehension outcomes in accordance with different task requirements, and reported exerting greater effort when specific task demands were present. Less skilled readers, without regard to the different task demands brought about by different instructions, attributed successful outcomes to internal factors and failure outcomes to external factors, and, particularly, were less likely to ascribe lack of effort as a cause for failure.

The most striking finding of this study is the effects of instructions upon subjects' various aspects of performance. It is argued that the two types of instructions implemented in this study can be viewed as two levels of metacognitive instructions. In particular, the higher level of instructions, specific instructions, had significant impacts upon subjects' cognitive (i.e., comprehension), metacognitive (i.e., evaluation and regulation) , and, to a lesser extent, attributional performance. Skilled readers, under specific instructions, demonstrated better monitoring and comprehension performance, and were inclined to believe more in their own power to control outcomes. These patterns of results appear to be interrelated. Skilled readers' metacognitive skills enhanced their belief in themselves and in strategic effort; on the other hand, their self-confidence enabled them to be willing to implement effortful strategies. More importantly, not only skilled readers, but less skilled readers also benefited from specific instructions. Less skilled readers had better comprehension performance and more accurate comprehension predictions under specific instructions than under general instructions. In regard to their attributions to effort for successful outcomes, general and specific instructions, then, had similar impacts: both types of instructions appeared to elicit goal-directed, effortful, reading behaviors that are related to effort attributions. On the other hand, less skilled readers appeared to be less able to effectively use multiple standards for critical comprehension evaluation without further guidance (i.e., other than provisions of specific standards and examples), and tended to view failure as uncontrollable, particularly when facing more complex task demands. It is speculated that less skilled readers showed minimal improvement in using multiple evaluation standards under specific instructions because they did not know *how* to apply the standards (e.g., strategic backtracking, using contextual clues). Further, because of their metacognitive difficulties in this aspect, they tended to view failure as uncontrollable. Of course, it is also possible that because of their low self-concept of ability, less skilled readers failed to use appropriate strategies for effective comprehension evaluation and regulation. All in all, these analyses illustrate the interactive nature of metacognitive and motivational aspects of reading comprehension, and the importance of investigating these aspects in a multidimensional context.

9.3.2 Research Paradigm Reexamined

The error detection task has been the most popular research paradigm used to examine readers' comprehension monitoring processes and strategies. However, as discussed in Chapter 4, many investigations have utilized the error detection paradigm with no control of confounding variables and evaluation standards. In addition, in most studies, comprehension monitoring measures were not obtained in conjunction with comprehension performance measures to examine linkage between comprehension monitoring behavior and comprehension performance. In this study, the error detection task was modified to avoid these methodological pitfalls. With confounding variables such as background knowledge and passage difficulty being experimentally controlled, and linkage between monitoring measures and comprehension measures directly examined, the results of this study demonstrate reliable differences in monitoring processes and strategies between skilled and less skilled readers, and thereby corroborate the findings of previous comprehension monitoring research.

While some researchers have questioned the utility of the error research paradigm as an approach to investigating comprehension monitoring (e.g., Winograd & Johnston, 1982), the results of this study demonstrate that with careful modifications, the error detection paradigm is suitable for examining the complex and interwoven metacognitive and motivational components of reading comprehension and monitoring. First, with the design of two levels of instructions, readers' spontaneous and instructed use of multiple evaluation standards, and interactions between evaluation standards and individual differences can be analyzed. Second, with the computer on-line processing devise, both the process (i.e., evaluation) and the strategy (i.e., regulation) aspects of comprehension monitoring can be investigated. Third, combined with the performance prediction paradigm, both on-line and off-line monitoring measures are employed and converging data can be collected. Finally, with the inclusion of an attribution measure, the interactive nature of the metacognitive and motivational aspects of reading comprehension and monitoring can be examined. In brief, the results of this study demonstrate that a well-designed error detection task can offer a unique opportunity to examine the complexity of comprehension monitoring in a multidimensional context.

9.3.3 Issues for Future Research

While the analyses presented in the previous section illustrate the merits of the modified error detection paradigm employed in this study, several important limitations should be addressed, further refinement of the research paradigm is needed, and unresolved issues should be examined in future studies.

An important limitation has to do with the data that unfortunately are lacking in this study. Because memory measures (e.g., recall of gist of passage content or inconsistent information) were not obtained along with comprehension and monitoring measures, memory failures could be a confounding variable in interpreting the differences in monitoring and comprehension performance between skilled and less skilled readers observed in this study. It is suggested that memory measures should be added in future studies if the present error detection paradigm is to be utilized.

Another limitation, which is related to the first one, has to do with the on-line processing computer program developed for this study: it does not allow readers to go back to the passage when they are answering comprehension questions. As a result, readers' strategic backtracking to question cues cannot be examined, and the relationship between strategic backtracking and comprehension performance cannot be analyzed. In addition, the computer device only records the number and time of exposure of each sentence; it does not record the sequence of sentence exposure. Hence, readers' patterns of reinspection for inconsistent information (e.g., 2,3,2, or 2,3,4,5,2,5) cannot be investigated. Modification of the on-line processing program, or development of alternative devices, should attempt to resolve these limitations so that flexible use of comprehension monitoring strategies can be investigated.

In addition, the results of this study indicate that strategy use appears to be critically related to the nature of the task (e.g., search for nonsense words versus search for inconsistency). A possible direction for future research would be to study in detail the text and task factors associated with more versus less strategic reading of different kinds of reading materials, and the conditions under which readers of different levels of skills will use the variety of strategies they possess.

Not only the strategy aspect but also the evaluation aspect of comprehension monitoring require further investigation. In this study, only three types of evaluation standards (i.e., lexical, syntactic, and internal consistency) were investigated. As pointed out by Baker (1985), effective comprehension monitoring involves many other evaluation standards as well (e.g., external consistency, propositional cohesiveness, structural cohesiveness, informational completeness). Moreover, there are some indications that children's ability to use different standards of evaluation does not develop at the same rate (Baker, 1984a, 1984b; Zabrucky & Moore, 1989). For example, Zabrucky and Moore (1989) reported that the lexcial standard and the external consistency standard develop fairly early and are often employed by children, whereas the internal consistency standard develops late and its use in children is related to both age and reading proficiency. In this study, less skilled readers seemed to rely on the lexical standard, and skilled readers, the syntactic standard, spontaneously. Additional research is needed to examine possible developmental processes for various standards of evaluation in children with different levels of reading skills.

Another important finding of the evaluation aspect of comprehension monitoring is that less skilled readers tended to overestimate their comprehension performance. Although skilled readers in this study did not display a tendency to overestimate their comprehension performance, it should be noted that in other studies with adult readers, there is evidence that even skilled adult readers tend to overestimate their comprehension performance (for reviews see Baker, 1989; Pressley & Ghatala, 1990a). Future studies that are focused on factors which may contribute to readers' overconfidence and ways to improve comprehension prediction are needed.

With respect to the motivational aspect of comprehension monitoring, the inclusion of an attribution measure along with the error detection task in this study represents one of the few attempts to examine the relationship between comprehension monitoring and attributional beliefs. It should be pointed out that the attribution measure employed in this study focused on readers' attributions about comprehension performance rather than monitoring performance. It would be worthwhile in future research to address the direct relationship between monitoring performance and attributions (e.g., causes for success or failure in error detection or in comprehension prediction accuracy).

It should also be pointed out that, while the four causal attributions (i.e., effort, ability, task, luck) examined in this study are the ones most emphasized in previous research, they do not represent all possible causal perceptions (Weiner, 1983). For example, Hiebert, Winograd, & Danner (1984) substituted two causal attributions (i.e., paying attention, studying) for the single cause of effort in their study of children's attributions in different aspects of reading and found that these two causes were particularly salient to children. In addition, there is evidence that children may view ability and task difficulty in several different aspects (e.g., ability as fixed versus incremental, see Dweck & Bempechat, 1983; task difficulty for oneself versus for others, see Hiebert et al., 1984). The interactive effects of attributions with outcomes and instructions observed in this study also seem to indicate that the four causal attributions may have different implications in different settings. It is therefore suggested that future studies should attempt to investigate causal attributions in a more refined manner (e.g., include several dimensions of effort such as strategy-based effort, effort related to mastery of specific skills, and blind effort) and obtain readers' interpretations of their specific attributions (e.g., What do you mean that the story is too difficult ? Can you give me an example?). The use of a rating scale indicating the relative importance of each specific cause, instead of a forced-choice format in which only one specific cause can be chosen, is also recommended so that attributions across causes can be directly compared and better scales can be developed to obtain higher reliability.

On the other hand, while the results of this study demonstrate that skilled readers outperformed less skilled readers in various aspects of comprehension monitoring, their performance was still far from perfect. For example, the average error detection rate for skilled readers under specific instructions was 66%. There appears to be considerable room for improvement in comprehension evaluation skills even for skilled readers. It is thus suggested that direct instruction in comprehension monitoring skills would be beneficial to skilled as well as less skilled readers. The consistently strong effects of specific instructions upon monitoring and comprehension performance revealed in this study indicate that comprehension monitoring intervention is an area of research that deserves further investigation. However, the minimal improvement displayed by less skilled readers under specific instructions in this study indicates that they may require instructions other than just provisions of evaluation standards and examples (also see Zabrucky & Moore, 1989). Future research should examine more precisely whether students of different levels of reading proficiency would require different types of comprehension monitoring instruction and what type of instruction would be more helpful to readers of lower levels of reading skills.

Finally, the findings of this study underscore the importance of examining the interactive nature of the metacognitive and motivational variables of reading comprehension and monitoring and point to the need of investigating these variables across settings (i.e., in different contexts). In particular, the dependency of readers' attributions on contextual factors has not been emphasized in previous studies. This study also raises some questions about the interpretation of learned helplessness in poor readers as reported in the literature. Therefore, a promising area of future research has to do with the interactive nature of the metacognitive and motivational aspects of reading comprehension and monitoring, and the ways different groups of children monitor their comprehension and display their motivational beliefs in different situations or settings.

10. Exploring the Relations among Comprehension Monitoring Components and Reading Performance

While the results of the three studies reported earlier revealed that all four components (i.e., knowledge, process, strategy, goal/motive and attribution) of comprehension monitoring are related to comprehension performance, their relative importance and interrelationships remain to be answered. In this chapter, the statistical technique, path analysis, was employed to examine the interrelations among the components and comprehension performance.

10.1 Statistical Considerations

Readers may question the choice of path analysis over some other statistical approaches (e.g., simple correlation or standard multiple regression). Keith (1988a, 1988b) pointed out several advantages of path analysis as a statistical technique, two of which are relevant to the present research. First, path analysis provides a very theory-bound approach for the analysis of social science data. Second, it allows the calculation of indirect as well as direct effects. For the present research, a model of comprehension monitoring has been developed; relations among the components and comprehension are inferred from an explicit theory which has been detailed in chapter 2. Moreover, examinations of the interrelations among the components and the relative importance of each component to comprehension performance require more complex analyses than simple correlational or standard multiple regression analyses. For example, attribution may not affect comprehension directly, but rather may affect comprehension indirectly by leading readers to use more effortful strategies for resolving comprehension problems. On the other hand, metacognitive knowledge may affect comprehension directly by providing a better understanding of text structure as well as indirectly by leading readers to evaluate their degree of comprehension more critically. While these indirect effects are lost in standard multiple regression analysis, they are calculable in path analysis by multiplying and summing paths. Calculation of indirect as well as direct effects through path analysis may provides a clearer picture of the influences of various components of comprehension monitoring on comprehension performance, and therefore was the choice for testing the hypothesized model.

10.2 The Model

Prior to path analysis, the original model as illustrated in chapter 2 was modified based on the results of a confirmatory factor analysis (CFA). Inspection of the CFA factor loadings revealed that the attribution measures were not congruent with the goal/motive measures, both of which were presumed to measure the same construct labelled goal/motive and motivational factor in the original model. Based on the information provided by the CFA results, the attribution component was separated from the goal/motive component, and the original model was modified to include five components of comprehension monitoring (i.e., attribution, goal/motive, knowledge, process, and strategy) as determinants of the outcome component reading comprehension performance.

10.2.1 Structure of the Model

The hypothesized relationships among the components and comprehension performance in the modified model are briefly described here.

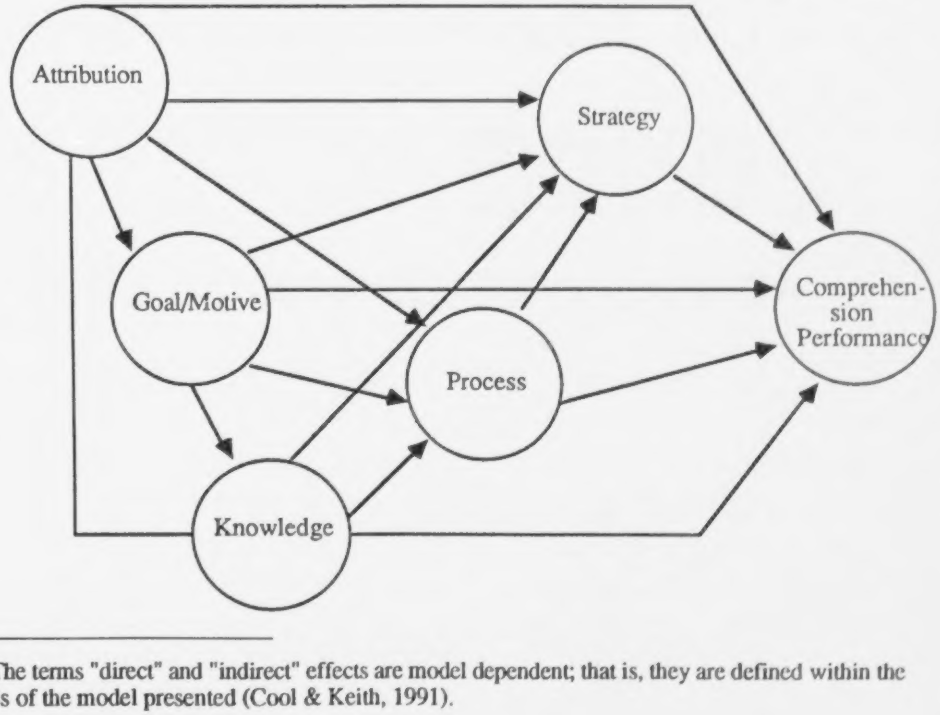
First, attribution as a motivational factor is considered to have direct influences on the four metacognitive components (i.e., goal/motive, knowledge, process, strategy), mainly because recent developments in metacognitive theory and research indicate that metacognitive and cognitive processes have roots in the preexisting self-system, and attributional belief is one of the notable variables of the self-system (Carr, Borkowski, and Maxwell, 1991; McCombs, 1986). As pointed out by Carr et al. (1991), although the self-system and self-regulating learning (e.g., comprehension monitoring) are thought to be bidirectionally linked, self-regulating is aided by perceptions of competence and a sense of control. Specifically, students with internal attributional orientations (e.g., effort or ability) are more willing to acquire metacognitive knowledge and strategies that are consistent with their sense of control, while students with external attributional orientations (e.g., other's help) may not be convinced of the usefulness of metacognitive knowledge and strategies as they feel that they have no control of their learning outcomes. It is in this sense that attributional beliefs directly affect the development of metacognition. Therefore, arrows hypothesizing causal links are drawn from attribution to the metacognitive variables: goal/motive, knowledge, process, and strategy. While current research on motivation, metacognition and academic performance usually focuses on the indirect effect of attribution (i.e., transmitted through metacognitive variables) on achievement, some other researchers also argue for direct influence of motivation on achievement (e.g., Gottfried, 1985). As a result, a direct link between attribution and comprehension performance is also hypothesized.

The interrelations of the four metacognitive components and comprehension performance are based on the following hypotheses. A meaning-oriented goal of reading, or a deep learning orientation, promotes the development of metacognitive knowledge, and both lead to more successful comprehension monitoring processes (i.e., evaluations). All three of these components(i.e., goal/motive, knowledge, process) in turn enhance the use of strategies to regulate comprehension, and strategy use leads to more successful comprehension performance. It is hypothesized that goal/motive, knowledge, and process also have direct influences on comprehension performance, and direct links between these three components and comprehension performance are drawn.

The structure of the model is illustrated in Figure 10-1. It should be noted that the arrows in the figure represent a " weak causal ordering". As Keith (1988b) put it, "they do not imply that one variable directly 'causes' another, but rather suggest that *if* two variables are related in some causal fashion, the cause goes in the direction of the arrow, rather than the reverse" (p.638). It should also be pointed out that the 'cause-and-effect' relationships depicted in the model do not rule out the possibility of two-way reciprocal relationships among the components from a longitudinal perspective. Longitudinal research, which is beyond the scope of the present research, may provide further information about the possible patterns of reciprocal relationships among the components. For the present research, the main focus is to determine the extent of direct and indirect effects of the components of comprehension monitoring on one another, and more importantly, on comprehension performance.[1]

Figure 10-1

Structure of the Hypothesized Model of Comprehension Monitoring



---

[1] The terms "direct" and "indirect" effects are model dependent; that is, they are defined within the confines of the model presented (Cool & Keith, 1991).

10.2.2 Measures of Model Components

As described in previous chapters, multiple measures were employed to measure each component of the comprehension monitoring model. The measures included in the series of path analyses are as follows.

Comprehension performance. The comprehension performance component was represented by two measures, one from student files and one from Study 3.

-- *CTBS comprehension score*: The CTBS comprehension subtest score available from student files was obtained for each subject.

-- *Passage comprehension score*: A sum score was computed for each subject by adding the six passage comprehension scores obtained from the error detection task.

Strategy. The strategy component was formed using two of the strategy measures described in Study 3.

-- *Target sentence look-backs* A mean score was computed for each subject by averaging the number of look-backs for inconsistent sentences in the error-inserted passages of the error detection task.

-- *Context sentence look-backs* A mean score was computed for each subject by averaging the number of look-backs for context sentences (i.e., sentences containing information that make target sentences inconsistent) in the error-inserted passages of the error detection task.

Process. The process component was formed using three of the process measures described in Study 3.

-- *Error detection score*: A sum score was computed for each subject by adding together the error detection scores for nonsense words, nonsense phrases, and inconsistent sentences.

-- *False identification score*: A sum score was computed by adding the number of false identifications across the six passages of the error task for each subject.

-- *Comprehension prediction score*: A sum score was computed for each subject by adding the prediction accuracy scores of the six passages of the error detection task.

Knowledge. The knowledge component was formed using two of the indicators described in Study 1.

-- *Interview knowledge score*: A sum score was computed for each subject by adding the 15 knowledge item scores from the interview.

-- *Questionnaire knowledge score*: A sum score was computed for each subject by adding the 15 knowledge item scores from the questionnaire.

Goal/motive. The goal/motive component was formed using three of the indicators described in Study 1 and Study 2. The LPQ deep and achieving approach scores were not included because results from Study 2 revealed that the two measures had very low correlations (r's = -.02 and 0.1 respectively) with reading performance.

-- *Interview goal/motive score*: A sum score was computed for each subject by adding the five goal/motive item scores from the interview.

-- *Questionnaire goal/motive score*: A sum score was computed for each subject by adding the five goal/motive item scores from the questionnaire.

-- *LPQ surface learning approach score*: A sum score was computed for each subject by adding the six surface motive scores and six surface strategy scores of the Learning Process Questionnaire (LPQ).

Attribution. Effort and ability attribution indicators for success outcomes, and effort and luck attribution indicators for failure outcomes described in Study 3 were used to calculate success and failure scores for each subject to form two measures of the attribution component.

The reason for using only effort and ability attribution indicators for calculation of success scores was that they are considered to be critical for the development of metacognition and for academic achievement (Carr et al., 1991). The formula 2E + 1/2 A as suggested by Carr et al. , where E is effort and A is ability, was used to form success scores. Carr et al. pointed out that effort attributions were more heavily weighted for scoring because strategy use is an effortful and planful behavior. Ability attributions for success, though important, play a lesser role in metacognitive development because students with strong ability attribution are less likely to put forth the effort for learning and carrying out strategies.

With respect to failure attributions, although Carr et al. used the same formula to calculate failure scores, the ability variable was replaced by the luck variable for computing failure scores in the present research. That is, the formula was modified to be 2E + 1/2 L, where E is effort and L is luck, to form failure scores. It is argued that attributing failure to a lack of ability reflects a perception that failure is internal, stable, uncontrollable and thus is more difficult to overcome. Also, attributing failure to a lack of ability is not compatible with attributing failure to a lack of effort which implies that failure is internal, unstable, and more controllable. In other words, ability attributions for failure play a detrimental role in metacognitive development and academic achievement, and therefore should not be included for computing failure scores. Instead, including luck attributions for failure in forming failure scores seems more reasonable because luck is an unstable factor and may change from time to time. Indeed, Schneider, Korkel, and Weinert (1987) included effort and luck attributions of failure in calculating an attributional style score in their research on attribution, metamemory, and memory behavior. Luck, however, is considered less controllable than effort and therefore was less weighted for scoring in the present research.

-- *Attributions of success score*: A sum score using the 2E + 1/2A formula for calculating attributions for success outcomes was computed for each subject .

-- *Attributions of failure score*: A sum score using the 2E + 1/2 L formula for calculating attributions for failure outcomes was computed for each subject .

In sum, 14 measures were included for representing the six model components. The means and standard deviations of the 14 measures, and the intercorrelations between the measures are displayed in Table 10-1.

10.2.3 Factor Scores of Model Components

An unrotated first principal component analysis was performed for each model component, using component measures described above as observed variables (e.g., error detection scores, false identification scores, and comprehension prediction scores were the three measures for the factor analysis of the process component). In each analysis, a single-factor score, a weighted composite according to the factor loadings of the measures, was generated for each subject. The factor loadings of the measures for each component are shown in Figure 10-2.

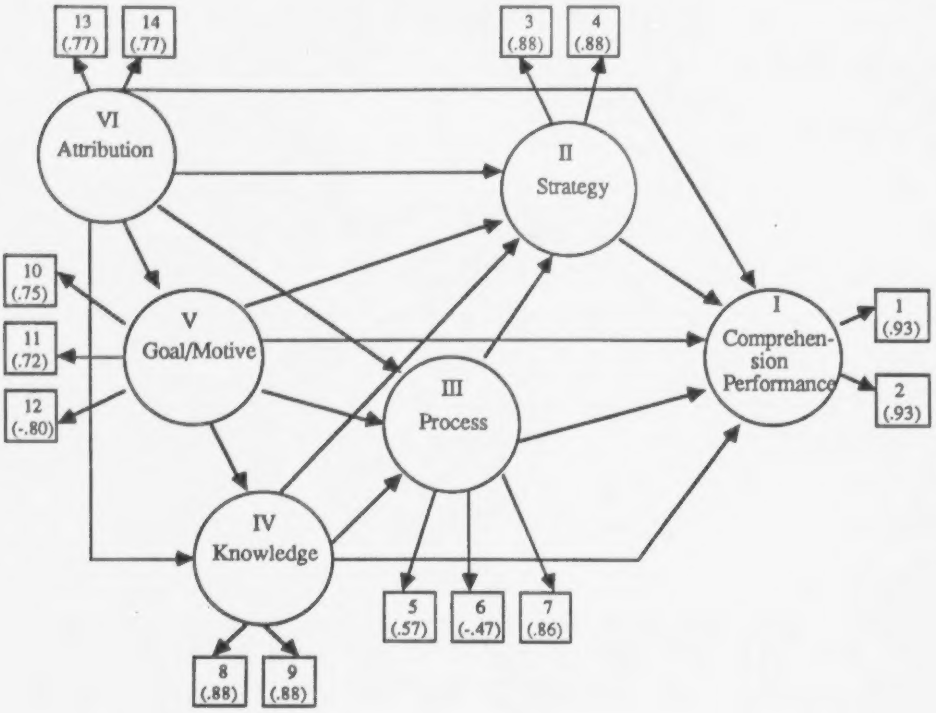
Table 10-1

Measure Means, Standard Deviations, and Intercorrlations

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. CTBS comprehension	1.00													
2. Passage comprehension	.73	1.00												
3. Target Sentence look-backs	.26	.21	1.00											
4. Context Sentence look-backs	.33	.25	.56	1.00										
5. Error detection	.44	.33	.26	.22	1.00									
6. False identification	-.41	-.41	-.16	-.14	.11	1.00								
7. Comprehension prediction	.50	.68	.18	.10	.25	-.23	1.00							
8. Interview knowledge	.65	-.42	.08	.24	.03	-.25	.26	1.00						
9. Questionnaire knowledge	.50	.31	.19	.14	.36	-.07	.31	.53	1.00					
10. Interview goal/motive	.57	.26	.10	.24	.21	-.17	.13	.62	.45	1.00				
11. Questionnaire goal/motive	.45	.27	.23	.23	.10	-.17	.23	.29	.36	.29	1.00			
12. LPQ surface approach	-.62	-.50	-.26	-.21	-.25	.21	-.43	-.46	-.39	-.41	-.38	1.00		
13. Attribution for success	-.19	-.15	.30	-.07	-.16	.20	-.10	-.11	-.10	-.22	-.15	.14	1.00	
14. Attribution for failure	-.14	.11	.13	.11	.08	-.21	.08	.13	.06	.02	.16	-.08	.19	1.00
Mean	50.68	22.53	.35	.45	3.79	8.09	7.53	42.05	40.85	13.14	14.27	37.22	3.27	1.53
Standard Deviations	33.82	4.00	.38	.52	1.90	12.35	2.15	7.11	6.03	3.81	3.09	7.35	2.14	1.91

Note: N = 59; LPQ = Learning Process Questionnaire; CTBS = Canadian Tests of Basic Skills

Figure 10-2
Hypothesized Model
with Factor Loadings of the Measures for Each Model Component


13 (.77)
14 (.77)
3 (.88)
4 (.88)
VI Attribution
II Strategy
10 (.75)
11 (.72)
12 (-.80)
V Goal/Motive
I Comprehension Performance
1 (.93)
2 (.93)
III Process
IV Knowledge
5 (.57)
6 (-.47)
7 (.86)
8 (.88)
9 (.88)

Note:

1. CTBS Comprehension; 2. Passage Comprehension;
3. Target Sentences Lookbacks; 4. Context Sentences Lookbacks;
5. Error Detection; 6. False Identification; 7. Comprehension Prediction Accuracy;
8. Interview Knowledge; 9. Questionnaire Knowledge;
10. Interview Goal/Motive; 11. Questionnaire Goal/Motive; 12. LPQ Surface Approach;
13. Attributions for Success; 14. Attributions for Failure.

Factor Loadings are in parentheses.

In sum, six unrotated first principal component analyses were performed, one for each model component, and six factor scores were generated for each subject. These factor scores were estimates of the scores subjects would have obtained on each of the model components had they been directly measured, and were to be used in the subsequent series of path analysis. The correlations among the six model components using factor scores as measures are shown in Table 10-2. The reason for using factor scores was to reduce the possibility of measurement error as a major problem in interpreting results of path analysis. As Keith (1988a) noted:

> Lack of reliability in the variables in a path analysis can serve to inflate or deflate the size of a path, depending on which variables are unreliable. If there are several measures of a variable available, one method of dealing with this problem is to factor analyze those variables and use the factor scores as a more reliable, more valid measure of the construct. (p.356)

Table 10-2

Correlations among Model Components

Component	I	II	III	IV	V	VI
I Comprehension	1.00					
II Strategy	.32	1.00				
III Process	.77	.28	1.00			
IV Knowledge	.58	.21	.38	1.00		
V Goal/Motive	.64	.32	.43	.65	1.00	
VI Attribution	-.03	.18	-.03	.00	-.08	1.00

10.2.4 Analysis of the Model

Computationally, simple path analysis can be estimated through ordinary multiple regression analysis; the Beta weights (standardized partial regression coefficients) from the regression analysis are used as estimates of path coefficients (Kenny, 1979; Keith, 1988a). For the present research, a series of multiple regression analysis, using factor scores as measures, were performed. Each new regression was entered sequentially, according to the arrows drawn in the hypothesized model as illustrated in figure 10-1. The sequence of operations was:

(1) regress comprehension performance on all of the comprehension monitoring components (i.e., attribution, goal/motive, knowledge, process, and strategy), yielding the five causal paths of direct influence on comprehension performance;

(2) regress strategy on attribution, goal/motive, knowledge, and process, yielding the four causal paths of direct influence on strategy use;

(3) regress process on attribution, goal/motive, and knowledge, yielding the three causal paths of direct influence on monitoring process;

(4) regress knowledge on attribution and goal/motive, yielding the two causal paths of direct influence on metacognitive knowledge;

(5) regress goal/motive on attribution, yielding one causal path of direct influence on the goal/motive component.

Indirect effects were calculated by multiplying and summing paths. For example, the indirect effect of knowledge on comprehension through process and strategy was calculated by, first, multiplying the knowledge - process path coefficient and the process - comprehension path coefficient, second, multiplying the knowledge - strategy path coefficient and the strategy - comprehension path coefficient, and third, summing up these two indirect path coefficients.

Finally, direct and indirect effects were summed to determine the total effect of one component on another.

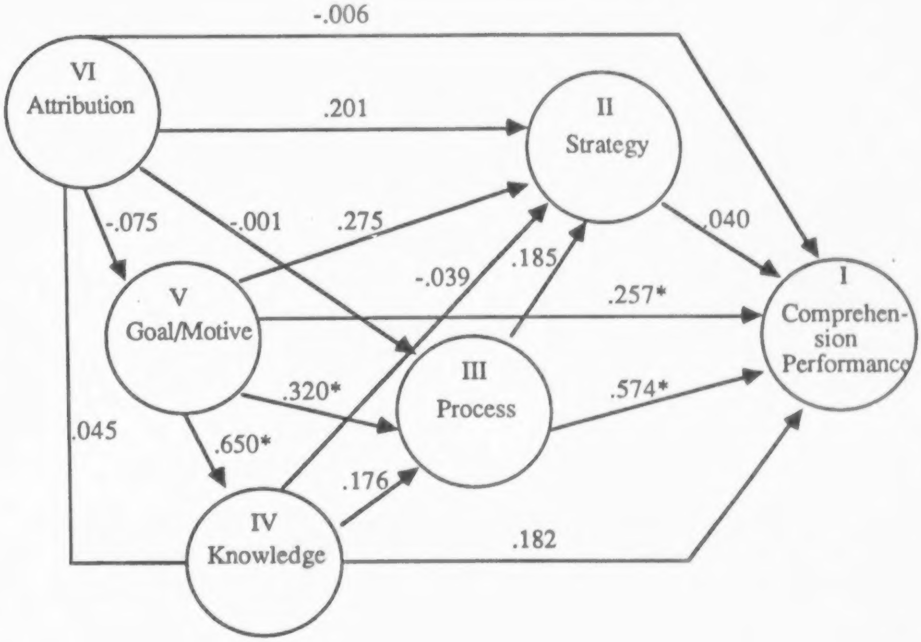
10.3 Results and Discussion

The results of the series of path analysis are presented in Figure 10-3. The total effects (i.e., direct as well as indirect) of the components on one another are detailed in the subsequent sections. For illustration purposes, the actual computations of the total effect of knowledge on comprehension are presented here to show how the effects of one component on another are derived.

First, the path coefficients shown in Figure 10-3 indicated the amount of change in standard deviation units in the outcome variable for each SD (standard deviation) change in its presumed cause while holding other variables constant (Keith, 1988b). The path coefficient of .182 from knowledge to comprehension suggested that if we change metacognitive knowledge one standard deviation, we would change comprehension performance .182 of a standard deviation while holding other variables such as attribution, goal/motive, process, and strategy constant. In other words, the path coefficient of .182 indicated the amount of direct effect of knowledge on comprehension in standard deviation units. Nevertheless, metacognitive knowledge also affected comprehension indirectly, via monitoring process and strategy use. The indirect effect of knowledge on comprehension through process was .176 x .574 = 0.101, and through strategy was -.039 x .040 = -.002 (i.e., indicating negative effect). Furthermore, its indirect effect through process by strategy was .176 x .185 x .040 = .001. Summing up the direct and indirect effects, the total effects of knowledge on comprehension were estimated to be .182+.101-.002+.002 = .282.

In the following sections, the effects of the five comprehension monitoring components on comprehension performance is first discussed, and the influences of the five monitoring components on one another are then analyzed.

Figure 10-3
Path Analysis of the Model of Comprehension Monitoring


-.006
VI
Attribution
.201
II
Strategy
-.075
-.001
.275
.040
.185
-.039
V
Goal/Motive
.257*
I
Comprehen-sion
Performance
III
Process
.320*
.574*
.045
.650*
.176
IV
Knowledge
.182

*$p < .05$

10.3.1 Effects on Comprehension Performance

Table 10-3 displays the direct, indirect, and total effects of the five comprehension monitoring components on comprehension performance. It can be seen that within the hypothesized model of comprehension monitoring, process had the strongest direct effect (path = .574, $p \leq .0001$) on comprehension, suggesting that effective on-going comprehension evaluation increases comprehension performance. The path from goal/motive was the second strongest (path = .257, $p \leq .014$), indicating that a more meaning-oriented goal of reading leads to more successful comprehension.

When indirect effects were also considered, goal/motive turned out to the most important component affecting comprehension performance (total effect = .602), mainly due to its large indirect effect (.345; through knowledge, or through knowledge by process, etc.). The indirect effect of process via strategy was minimal (.007) and therefore the total effect of process was primarily a direct effect. Knowledge was the third important component affecting comprehension, both directly (.182) and indirectly (.101). Attribution and strategy appeared to have no meaningful direct or indirect effect on comprehension performance.

However, interpretation of the above findings, particularly regarding the role of goal/motive, must be made with considerate caution.[2] Given a relative high correlation between goal/motive and knowledge ($r = .65$), it is possible that goal orientations of reading involve metacognitive knowledge of various aspect of reading. Therefore, the finding about the role of goal/motive implies that a more meaning-oriented goal of reading, which is substantially associated with a higher level of metacognitive knowledge about reading, lead to more successful reading comprehension.

Table 10-3

Effects on Comprehension Performance

Component	Direct effect	Indirect effect	Total effect
Strategy	.040	---	.040
Process	.574	.007	.581
Knowledge	.182	.101	.282
Goal/Motive	.257	.345	.602
Attribution	-.006	-.018	-.024

10.3.2 Effects on Strategy Use

As shown in Figure 10-3, none of the direct paths to strategy reached significance. The direct and indirect effects of the four model components on strategy are presented in

---

[2] The presence of multicollinearity is a problem researchers often have to face when interpreting results of multiple regression analysis of social science data. The most commonly used method for detecting multicollinearity is to look for high correlation coefficients between the independent variables included in a regression equation (Kerlinger, 1979). Berry and Feldman (1985) suggested that "the most reasonable test for multicollinearity is to regress each independent variable in the equation on all other independent variables, and look at the R^2 for these regressions; if any are close to 1.00, there is a high degree of multicollinearity present" (p. 43). For the present research, inspection of the correlations among the five independent variables as shown in Table 10-2 revealed that except for the correlation between goal/motive and knowledge, the correlations among other variables were relatively low (from .00 to .43). Using the method suggested by Berry and Feldman, the R^2 values of regressing each independent variable on the other four ranged from .23 for attribution, .41 for strategy, .48 for process, to .66 for knowledge and .70 for goal/motive. The two analyses indicated a relatively high degree of collinearity exists between the goal/motive and the knowledge components. The validity of the two components as two separate constructs will be further examined in the general discussion section.

Table 10-4. In comparison to other components, goal/motive had strongest total effect on strategy (.321), suggesting that a meaning-getting orientation increases the use of strategies to solve comprehension problems. Attribution with an emphasis on effort seemed to directly increase strategy use (.201), but such an attributional orientation had negative indirect effects (-.022) through its influences on other components, and as a result its total effect (.179) on strategy use decreased. The monitoring process affected strategy use (.167) to a lesser extent, and the total effect of knowledge on strategy use was minimal.

Table 10-4
Effects on Strategy Use

Component	Direct effect	Indirect effect	Total effect
Process	.167	---	.167
Knowledge	-.039	.029	-.010
Goal/Motive	.275	.046	.321
Attribution	.201	-.022	.179

10.3.3 Effects on Monitoring Process

Table 10-5 displays the effects of the three components on the comprehension monitoring process. The strongest direct effect was from goal/motive (path = .32, $p \leq .05$). With its influence through knowledge (indirect effect = .114), goal/motive had a total effect of .434 on process, suggesting a meaning-getting goal lead to a higher level of on-going comprehension evaluation. Metacognitive knowledge also directly influenced comprehension evaluation (.176), but the direct effect did not reach significance. Attribution played little role in the monitoring process.

Table 10-5
Effects on Monitoring Process

Component	Direct effect	Indirect effect	Total effect
Knowledge	.176	---	.176
Goal/Motive	.320	.114	.434
Attribution	-.001	-.025	-.026

10.3.4 Effects on Metacognitive Knowledge

The effects of goal/motive and attribution on metacognitive knowledge are presented in Table 10-6. The direct path from goal/motive to metacognitive knowledge was highly significant (path = .65, $p \leq .0001$), suggesting that a meaning-getting orientation of reading increases the development of metacognitive knowledge. In contrast, attribution had little effect on the acquisition of metacognitive knowledge (total effect = -.005).

Table 10-6

Effects on Metacognitive Knowledge

Component	Direct effect	Indirect effect	Total effect
Goal/Motive	.650	---	.650
Attribution	.045	-.049	-.005

10.3.5 Effects on Goal/Motive

Within the hypothesized model of comprehension monitoring, only a path from attribution to goal/motive was suggested. The result of path analysis revealed that attribution did not have much impact on the formation of reading goals or motives (path = -.075).

10.4 General Discussion

Research on metacognition, comprehension monitoring, and reading comprehension is consistent in pointing to the importance of variables such as metacognitive knowledge, on-going comprehension evaluation, strategy use, and more recently, attribution in their influence on comprehension performance. However, most studies have not investigated all these variables simultaneously, that is, within a single research setting. Moreover, few have focused on indirect as well as direct effects. The present research addressed the importance of both of these considerations. By developing a model of comprehension monitoring and examining various components of comprehension monitoring together, the present research was able to delineate more precisely both the direct and indirect influences of these components of comprehension monitoring on comprehension performance. In the following sections, important findings of this research are highlighted and further discussed, implications for theory development, future research, and educational applications are offered.

10.41 Research Findings Synthesized and Reinspected

The results of the series of path analysis suggested that the monitoring process had the strongest direct effect on comprehension performance. When indirect effects were also considered, goal/motive became the most influential component affecting comprehension performance, mainly because it influenced comprehension directly, and at the same time influenced knowledge and process, which, in turn, influenced comprehension performance. However, as pointed out earlier, interpretation of the role of goal/motive in comprehension performance must be made with some caution because of the relatively high correlation between goal/motive and knowledge. Taken together, the research findings suggest that, within the hypothesized model of comprehension monitoring, goal/motive/knowledge and process, in comparison to strategy and attribution, had relatively greater effects on comprehension performance.

With respect to the interrelations among the comprehension monitoring components, goal/motive turned out to be the most powerful factor influencing other components; its total effects on knowledge, process, and strategy were .65, .434., and .321, respectively. Interpretation of this finding, again, should be cautious in view of the relatively high correlation between goal/motive and knowledge. Process also influenced strategy use, but its impact on strategy (.167) was not significant. Although attribution had its largest direct effect on strategy use (.201), none of the path coefficients from attribution to other monitoring components were significant.

In regard to the relatively high correlation between goal/motive and knowledge, while it is possible that the high correlation may reflect similar underlying traits shared by the two components, it is also possible that it may be partly due to the measurement method used to measure these two components. Recall that both components were assessed through the interview and the questionnaire techniques. Hence, the high correlation between the two components may reflect that they were measured by the same methods in which similar scoring scales were employed. The separability of the two components (i.e., the two components as two distinct constructs) should be further tested with multiple and different measures (e.g., self-report scales vs. observation measures).

On the other hand, as pointed out earlier in chapter 7, the goal/motive construct has rarely been explored in the metacognitive literature and may not have been adequately conceptualized in the present research. In this context, it should be noted that recent advancement in achievement goal theory of motivation may indicate how the goal/motive construct can be operationally defined. According to researchers in this area (e.g., Ames & Archer, 1988; Dweck, 1985; Nicholls, 1984), there are two types of achievement goals which represent two different orientations towards learning. Essentially, students who adopt the "mastery" or "task involvement" achievement goal are usually intrinsically motivated to learn, strive to master new skills, and are concerned about the process of learning. In contrast, students who adopt the "performance" or "ego involvement" goal are concerned about being judged by others and about outperforming others. Researchers in this area claim that students' achievement goal orientations are critical to their strategy use in learning. While Biggs' Learning Process Questionnaire captures some aspects of these goal orientations (e.g., the achieving learning approach and the surface learning approach to a certain extent resemble the performance goal orientation), further investigation of the goal/motive component along the two contrasting achievement goals may help identify the uniqueness of the construct and thereby lessen its association with the knowledge construct.

The overall small size of effects of attribution on comprehension and, particularly, on other comprehension monitoring components was somewhat unexpected, in view that substantial positive effect was obtained in previous investigations of attribution and metacognition (e.g., Reid & Borkowski, 1987; Carr et al., 1991). One possibility is that differences in findings may be due, in part, to differences in measurement approach. As discussed in chapter 9, the present research employed a situational approach to measure attributions in that attributions were solicited after subjects finished their comprehension passages, whereas other studies (e.g.Carr et al., 1991) examining attribution and metacognition usually adopted a dispositional approach in which questionnaires were used to assess students' self-attributions about hypothetical tasks. As pointed out by Marsh, Carns, Relich, Barnes, and Debus (1984), these two approaches to attributional research may not yield similar results[3]. In their opinion:

> It is important to recognize that the two approaches -- situational and dispositional -- are different ways of looking at the same problem and that neither is inherently superior to the other.The attribution process is systematically affected by both situational characteristics and individual differences, and the study of both approaches will lead to a better understanding of attributional research. However, it is also clear that findings derived from one approach need not agree with those obtained with the other approach. (p. 4)

---

[3] It should be pointed out that the task-specific measure adopted in the present research was a bit different from Marsh et al.'s descriptions of situational studies in which subjects were typically asked to form attributions about hypothetical others on the basis of highly structured stimulus situations. Nevertheless, the task-specific method of the present research and the situational studies described by Marsh et al. shared one characteristic, in that both emphasized the manipulation of task and situational variables in assessing attributions. It is in this sense that the task-specific measure employed in this research represented a situational approach to attributional research.

It is possible that the relationship between attribution and metacognition found in previous studies revealed specifically how dispositional attributional beliefs are tied to the development of the metacognitive system. In contrast, the attributional beliefs displayed by the participants in the present research may by more affected by situational characteristics (e.g., instructions, task involvement, etc.) and may not reflect their dispositional tendencies. In brief, different measurement approaches may have accounted for the different findings between the present research and those of previous studies.

The small size of attribution effects may also be due to inadequacy of the measurement scale. The present research used a four-factor causal scheme (i.e., effort, ability, task, luck) and a forced-choice (i.e., only one of the four provided causes is allowed) format to assess attributions, a procedure typically found in attributional research of academic achievement in the 70's and early 80's (e.g., Pearl et al., 1980). However, recent development in the area of attributional research calls for more sophisticated measurement scales (e.g., given additional choices with a weighted scoring scale, or separate ratings of each perceived cause) to improve measurement reliability (Winograd & Niquette, 1988). Moreover, elaboration of the four standard causal schemes may reveal more precisely the relationship between attribution and metacognition.

Another puzzling finding of the present research was the minimal effect of strategy on comprehension performance. One possible explanation is that the two measures of the strategy component only measured one particular strategy -- the look-back strategy, and that readers' use of other strategies was not investigated. It should be noted that even the look-back strategy was not frequently used (Means = .35 for target sentence lookbacks and .45 for context sentence lookbacks). It may be the case that the error detection task employed to investigate the strategy aspect of comprehension monitoring was not powerful enough to elicit active strategy use. The relationship between strategy and comprehension should be further examined with multiple and more powerful strategy measures.

10.4.2 Implications for Model Development

The conceptual notion of comprehension monitoring has gone through certain important changes. The model of comprehension monitoring tested in the present research has evolved from the development of theory and research of the past two decades.

Classic studies of comprehension monitoring in the 70's began with an oral paradigm (e.g., Markman, 1977). Research on listening comprehension adequacy prompted reading researchers to examine developmental and individual differences in readers' comprehension monitoring skills. Research at this stage focused mainly on the monitoring process; comprehension monitoring was primarily viewed as an executive function with the evaluation aspect of monitoring as the focal point of interest (e.g., Baker, 1979). Along this line of research, inquiries about the reader's metacognitive knowledge about various aspects of reading also flourished (e.g., Myers & Paris, 1978). Subsequently, investigations of the relation between knowledge of monitoring and the monitoring process were launched (e.g., Garner & Kraus, 1981-1982). During the later half of the 80's, researchers attempted to differentiate more precisely the executive function of monitoring into two components. They contended that the utilization of repair strategies necessarily takes place when the reader's monitoring process is obstructed by a comprehension problem, and therefore comprehension monitoring includes the evaluation phase and the regulation phase (e.g., Zabrucky et al., 1986). Putting these different research directions into perspective, then, comprehension monitoring entails at least three components: knowledge, process, and strategy. Furthermore, as pointed out by Baker and Brown (1984a), how the reader monitors his/her comprehension depends largely on his/her perceived goal(s) of reading. Flavell's (1981) model of cognitive monitoring succinctly captures all these four essential components of monitoring. However, few studies have looked into all these four aspects of comprehension monitoring simultaneously. More recently, development in metacognitive theory focuses on motivational components of strategy-based cognition (e.g., Borkowski et al., 1990). Attempting to address the need for integrating most recent theory development into our conceptualization of comprehension monitoring, and the need for investigating related aspects of comprehension monitoring simultaneously, a multidimensional model of comprehension monitoring consisting of five components (i.e., attribution, goal/motive, knowledge, process, and strategy) was established in this research, multiple measures were employed to measure each component, and the component relationships to comprehension performance were tested through a series of path analysis.

The findings of the present research, to a certain extent, support a multidimensional view of comprehension monitoring. The relative importance of the five components to comprehension was demonstrated through a series of path analysis. While process and goal/motive were found to be two prominent factors contributing to comprehension performance, the roles of attribution and strategy in comprehension monitoring and comprehension performance, as discussed before, were less unambiguous and should be further tested with more stringent measures before solid conclusions could be made. The separability of goal/motive and knowledge as two distinct constructs should also be further investigated.

10.4.3 Implications for Educational Applications

Although more research is needed before specific guidelines for reading assessment and instruction should be made, tseveral general implications can be derived from the findings of this research.

First, should comprehension monitoring skills be an important instructional goal in the classroom? As shown in this research, effective comprehension monitoring is critical to successful comprehension. It is also shown that comprehension monitoring is a complex skill consisting of several components. These findings imply that comprehension monitoring is an important skill that should be taught to students, but teaching such a skill may involve many steps. It is suggested that goal/motive and process are the two components to which teachers should pay particular attention. Since process is also affected by goal/motive, fostering a meaning-getting orientation towards reading in children may be an important step that teachers should not ignore. The process component involves using different evaluation standards to monitor comprehension. It has been shown that the internal consistency standard is particularly difficult for students to apply. Teachers may consider teaching other standards (e.g., lexical standards, syntactic standards, or external consistency standards) before introducing students to the use of the internal consistency standard. To teach students to use these standards effectively, an understanding of text structure seems essential. In this context, the role of knowledge comes into play.

What types of procedures, then, can teachers use for assessment and instruction? Teachers may consider the use of a metacognitive questionnaire similar to the one used in Study 1 to obtain an overall index of students' attributional beliefs, perceived goals of reading, and knowledge of comprehension monitoring, with an in-depth interview as a follow-up focusing on specific questions. The information collected from the questionnaire or interview may be used to form instructional plans for teaching comprehension monitoring skills. Moreover, error detection passages like the ones used in Study 3 can be used as an assessment tool as well as instructional materials.

In sum, teaching monitoring skills is not a simple task. It is hoped that the research findings have provided us with a better understanding of comprehension monitoring, and that teachers may find the suggestions useful for improving children's comprehension monitoring skills.

PART THREE:
INTEGRATION

11. COMPREHENSION MONITORING: ANSWERED AND UNANSWERED QUESTIONS

In this chapter, research questions established in chapter 5 to guide the overall investigation are specifically addressed, although these questions were answered indirectly in previous chapters. In addition, some unresolved issues that should command further attention in future research are also discussed.

11.1 Research Questions Answered

Research question 1 concerns individual differences in the knowledge and goal/motive dimension of comprehension monitoring and the nature of assessment techniques in this dimension. Three subquestions were developed:

1a. Are there differences between skilled and less skilled sixth-grade readers in terms of their knowledge and goal/motive of comprehension monitoring as revealed in their interview responses?

1b. Are there differences between skilled and less skilled sixth-grade readers in terms of their knowledge and goal/motive of comprehension monitoring as revealed in their questionnaire responses?

1c. Which assessment technique (i.e., interview which requires heavy verbal demands vs. questionnaire which requires less verbal demand) assists in gaining more meaningful responses from the subjects?

Both of the interview and questionnaire results of Study 1 revealed significant differences between skilled and less skilled sixth-grade readers on various aspects of metacognition about reading and comprehension monitoring. In terms of the goal/motive dimension, skilled readers seemed to view meaning-getting as the goal of reading, exhibit higher self confidence and enjoy reading most of the time. In contrast, less skilled readers tended to maintain a decoding orientation towards reading and display a poor self image as a reader.

With respect to metacognitive knowledge, skilled readers consistently outperformed less skilled readers on all three categories (i.e., person, task, and strategy) of metacognitive knowledge about reading. In particular, skilled readers displayed greater awareness of certain characteristics of text structure and task demand, and reported greater use of context to solve comprehension problems. It should be noted, however, that less skilled readers displayed a level of understanding of how personal factors affect reading proficiency quite close to that of skilled readers.

Overall, the results obtained from the interview and the questionnaire were quite consistent. Even when verbal demands were minimized, the differences between the two reader groups were still evident in terms of their perceived goals and motives of reading, their awareness of text characteristics and task demands, and the use of context as reading strategies.

In regard to the merits of the two assessment techniques, the interview schedule has the advantage of obtaining rich and more comprehensive data and thereby provides greater insight into readers' flexible and strategic use of various reading strategies. On the other hand, the questionnaire format reduces verbal demands upon the respondents, takes less time in terms of administration and scoring, and is suitable in both individual and group settings. Therefore, the usefulness of the two techniques depends on the purpose of assessment. To obtain an overall index of students' comprehension monitoring skills, the questionnaire method is probably the choice. To gather specific information of individual students' comprehension monitoring strategies, the interview procedure may be the better option.

Research question 2 examines how goals/motives and strategies of comprehension monitoring relate to general learning motives and strategies. Two subquestions were formulated:

2a. Are there differences between skilled and less skilled sixth-grade readers in terms of their motives and strategies of learning in general as revealed in their responses to the Learning Process Questionnaire?

2b. What are the relationships between sixth-graders' motives and strategies of learning in general (as assessed by the Learning Process Questionnaire) and their goals/motives and strategies of comprehension monitoring in reading (as assessed by the interview and the questionnaire)?

In terms of learning approaches as revealed in their responses to the Learning Process Questionnaire in Study 2, the difference between skilled and less skilled readers was most evident in the surface learning approach. Less skilled readers' significantly higher scores on the surface approach indicated that they appeared to view school learning as an "unavoidable" task, and tended to get through it with minimal effort by relying on rote learning strategies for which extra work or reasoning is not required. In contrast, skilled readers' lower scores suggested that they did not rely on the surface approach to learning as much as less skilled readers did. However, skilled readers and less skilled readers were not significantly differed in terms of their deep and achieving learning orientations.

With regard to the relationships between sixth-graders' motives and strategies of learning in general as assessed by the Learning Process Questionnaire, and their reading goals/motives and strategies as assessed by the interview and the questionnaire, the strong negative correlation between reading motives/strategies and surface motives/strategies suggested that metacognition in reading to a certain extent is related to metacognition in learning because the surface approach represents limited metacognitive awareness of learning. It should be pointed out, however, that reading motives and strategies were barely related to deep and achieving learning approaches.

Research question 3 concerns individual differences in the process dimension of comprehension monitoring and the nature of assessment technique sin this dimension. Three subquestions were formulated:

3a. Are there differences between skilled and less skilled sixth-grade readers in terms of their comprehension monitoring processes as indicated by their error-detection rates and false identification rates?

3b. Are there differences between skilled and less skilled sixth-grade readers in terms of their comprehension monitoring processes as indicated by their predictions of comprehension performance accuracy?

3c. What are the relationships between the process measures and comprehension performance, and what are the relationship among the process measures (e.g.,., on-line measure -- error-detection rates vs. off-line measure -- self-judgements of comprehension accuracy) employed in the error-detection task?

Significant differences were found between skilled and less skilled sixth-grade readers in terms of their processes of comprehension monitoring. First, skilled readers' pattern of error identification indicate that they were more effective in using multiple standards to evaluate their comprehension. Less skilled readers, in contrast, appeared to rely more often on the lexical standard to evaluate their comprehension, reflecting a basic concern with the understanding of individual word meanings. This finding is consistent with the results of the goal/motive data. Less skilled readers were also inferior to skilled readers in detecting syntactic errors, indicating their limited awareness of grammatical well-formedness. More importantly, less skilled readers were less able than skilled readers to detect internal inconsistencies presented in the passages, indicating their relative failure to monitor their comprehension at the semantic level.

In addition, it was found that less skilled readers identified far more intact portions of the passages as problems and were less accurate at predicting comprehension success than skilled readers. In particular, less skilled readers tended to over-estimate their comprehension performance, indicating that they were not aware that they answered some of the questions incorrectly.

In brief, skilled readers, in comparison to less skilled readers, identified more inserted errors, committed far fewer identification mistakes, and predicted their comprehension performance more accurately. All these findings point to a higher level of comprehension evaluation skills in skilled readers.

With respect to interrelationships between the process measures and comprehension performance, correlational analyses indicated that error detection, false identification, and comprehension prediction were all significantly related to passage (i.e., error detection passage) comprehension performance (r's = .33, .-.41, .68, respectively). The off-line measure (i.e., comprehension prediction) was moderately related to the two on-line measures (r's = .25 with error detection, -.23 with false identification), while the two on-line measures (i.e., error detection and false identification, r = .11) showed little relationship to each other. None of the correlations between the process measures reached significance, indicating that they may be measuring different aspects of the monitoring process.

Research question 4 focuses on individual differences in the strategy dimension of comprehension monitoring and the nature of assessment techniques in this dimension. Two subquestions were developed:

4a. Are there differences between skilled and less skilled sixth-grade readers in terms of their comprehension monitoring strategies as indicated by their lookback behaviors during the error-detection task?

4b. What are the relationships between the lookback behaviors during error-detection performance and comprehension performance?

Skilled readers did not significantly differ from less skilled readers in terms of the number of rereadings for passages and for error-inserted statements. However, it was on the aspect of look-backs for context statements, statements containing information which made target statements inconsistent, that skilled readers distinguished themselves from less skilled readers. Skilled readers reexamined context statements significantly more often than did less skilled readers. It should be noted, however, that the correlation between context statements look-backs and passage comprehension performance was only moderate and did not reach the conventional level of significance (r = .25, p = .06).

Research question 5 concerns individual differences in the attribution dimension of comprehension monitoring and the nature of assessment techniques in this dimension. Two subquestions were formulated:

5a. Are there differences between skilled and less skilled sixth-grade readers in terms of their motivational beliefs as indicated by their attributional causes for their success or failure of comprehension during the error detection task?

5b. What are the interrelationships among sixth-grader's general learning motives (as assessed by the LPQ), their perceived goals/motives of reading (as indicated by the goal/motive component scores in the interview and the questionnaire), and their attributional causes for their success or failure of comprehension during error detection task?

Overall, the major difference found between skilled and less skilled readers was in their attributions of effort for failure outcomes. Less skilled readers judged effort as significantly more important in determining success than they judged lack of effort in determining failure, while no significant difference was found between skilled readers' effort attributions for success and for failure. This finding indicates that less skilled readers were less likely to ascribe lack of effort as a cause of failure. On the other hand, less skilled readers were not significantly different from skilled readers on other dimensions (i.e., ability, task, luck) of attributions.

There are some indications that skilled readers linked comprehension monitoring to comprehension performance, in that they attributed comprehension outcomes more often to effort when they were able to evaluate their degree of comprehension using specific standards provided by specific instructions. In contrast, less skilled readers appeared to be less able to link comprehension monitoring to comprehension performance, as they attributed success most often to effort and failure to task difficulty, disregarding the different task demands brought about by different instructions.

In regard to the interrelationships among the several measures of the goal/motive and the attribution components (e.g., LPQ approach scores, interview or questionnaire goal/motive measures, attribution measures) , no significant patterns of relationships were obtained.

Research question 6 examines how reading comprehension performance relate to the various dimensions of comprehension monitoring. Two subquestions were formulated:

6a. Which component in comprehension monitoring has the most powerful influence on reading comprehension performance?

6b. What are the interrelations among the comprehension monitoring components?

The results of path analysis suggest that the monitoring process had the strongest direct effect on comprehension performance. When indirect effects were also considered, goal/motive became the most influential component affecting comprehension performance, mainly because it influenced comprehension directly, and at the same time influenced knowledge and process, which, in turn, influenced comprehension performance. It should be pointed out the goal/motive and the knowledge components were relatively highly correlated ($r = .65$). Taken together, the research findings suggest that, within the model of comprehension monitoring developed in this research, goal/motive/knowledge and process, in comparison to strategy and attribution, had relatively greater effects on comprehension performance.

With respect to the interrelations among the comprehension monitoring components, goal/motive was the most powerful factor influencing other components. Interpretation of this finding, again, should be cautious in view of the relatively high correlation between goal/motive and knowledge. Process also influenced strategy use, but its impact on strategy was not significant. Attribution appeared to have no substantial influences on other comprehension monitoring components.

11.2 Some Unresolved Issues

While the series of studies implemented in this research have provided a better understanding of the complex relations among comprehension monitoring components and comprehension performance, many methodological as well as conceptual questions remain unanswered. These issues, although most have been discussed in previous chapters, are summarized in the following sections.

11.2.1 Measurement Issues

How can we measure each of the components of comprehension monitoring more accurately? In this research, multiple methods of assessment were employed to measure each aspect of comprehension monitoring. Some of these measures produced solid evidence, some did not.

The interview schedule and the questionnaire were the two measures used to measure the goal/motive and knowledge aspects of comprehension monitoring. The parallel results obtained from the two methods seemed to indicate that the two measures achieved satisfactory reliability. However, it has been pointed out before that the two measures can be further improved. For example, more items should be added to measure the goal/motive component to increase measurement reliability, while some existing questions that yield ambiguous responses should be reformulated or deleted. In addition, a more refined scoring scale should be developed to allow scoring of multiple answers that reflect strategic planning and flexibility.

Another issue also relates to the measurement of the goal/motive and knowledge components. It is speculated that the relatively high correlation between the two constructs may, in part, be due to similar methods used to measure the two constructs. That is, the correlation may reflect measurement similarity rather than construct overlaps. To avoid such a methodological pitfall, it is suggested that different methods be used to measure these two constructs in future studies. For example, if the interview method is used to investigate the goal/motive component, an entirely different method such as cross-age tutoring (i.e., older children helping younger children to accomplish a reading task, e.g., Garner, Macready, & Wagoner, 1984) may be employed to examine the knowledge component.

The error detection paradigm was used to investigate the process and strategy aspects of comprehension monitoring. The results indicated that although the paradigm can yield rich information about the complex comprehension monitoring process in terms of the use of multiple evaluation standards, it may not be a powerful measure of strategy use (i.e., errors such as nonsense words or phrases may be detected without explicit indication of strategy use). Employment of alternative measures of strategy use in future research seems necessary. Other research methods such as the cloze task (i.e., researchers or teachers ask students to fill in missing words in a passage and inquire about their use of strategies to figure out the missing words) or the think-along method (i.e., researchers or teachers ask students to read aloud and probe students' thinking with questions about their strategies) have been proven to be useful measures (Paris, 1991), and researchers may consider these techniques as alternatives to the often used error detection paradigm.

Among the multiple measures used in this research, the attribution measure may be the one that needs dramatic improvement in order to produce more meaningful results in future studies. As pointed out in chapter 10, the attribution measure utilized a four-factor causal scheme and a forced-choice format to assess attributions. Recent development in the area of attributional research indicates that such an approach to measuring attribution may not be adequate (Winograd & Niquette, 1988). Researchers call for more sophisticated measurement scales (e.g., given additional choices with a weighted scoring scale, or separate ratings of each perceived cause) to improve measurement reliability. Moreover, the conventional four-factor causal scheme should be further elaborated to reveal specific relationships between causal beliefs and metacognition. For example, the single cause of effort may be redefined into several dimensions such as strategy-based effort, effort related to mastery of specific skills, or just blind effort, so that the relation between metacognition and each particular aspect of effort can be delineated.

11.2.2 Conceptual Issues

In addition to the measurement issues discussed above, there are also conceptual issues that need to be addressed in future research. The central conceptual issue concerns the validity of the model of comprehension monitoring established in this research. To develop a componential model of comprehension monitoring, one has to consider which component should be included or excluded in the model. In the final stage of this research, a five-component model of comprehension monitoring was established. Three of the five components, goal/motive, knowledge, and process, were found to have greater influences on comprehension monitoring. On what basis, then, should the other two components, attribution and strategy, be included or excluded in future model development?

With respect to the role of strategy, it seems almost impossible not to include this component in a model of comprehension monitoring because the concept of monitoring logically implies the use of strategy to monitor comprehension. Moreover, the regulation aspect of comprehension monitoring has been the focus of recent comprehension monitoring research, and substantial relationship between regulation and comprehension performance was demonstrated (e.g., Zabrucky & Ratner, 1986, 1989). It appears, then, that the minimal effect of strategy upon comprehension monitoring obtained in this research was most likely due to inadequate measurement as discussed in the above section.

Second, let us examine whether attribution is an important component to be included in future comprehension monitoring models. Since the potency of attribution as an important factor affecting the development of metacognition was demonstrated in some other studies (e.g, Carr et al., 1991), it is possible that the nonsignificant results obtained in this research may be more related to measurement inadequacy discussed earlier than to conceptual problems. However, there are also indications that reconceptualization of the attribution construct may be necessary to provide more fruitful results in future investigations. The consistent effect of outcome upon attribution obtained in this research and in other studies (e.g., Marsh et al., 1984) points to the need of constructing two separate attribution constructs -- attribution of success and attribution of failure -- in future research. As pointed out by Marsh et al., "attributions do not generalize across outcomes and that any theoretical or empirical analyses that assume that they do must be viewed skeptically" (p. 6). In most studies examining attribution and metacognition (e.g., Schneider et al., 1987; Carr et al., 1991), attributions of success and failure were either treated as multiple measures of one attribution construct or combined to form an indicator of an individual's attribution style. Specific information concerning success or failure attributions to metacognition was not obtained in these studies. It is suggested that researchers may consider the separability of success attributions and failure attributions and investigate if different patterns of relationships exist between these two constructs and metacognition.

Furthermore, attribution was the only motivational variable included in the model of comprehension monitoring tested in this research. Some other motivational variables such as self-esteem, task persistency and expectancy of success may also be relevant to comprehension monitoring and comprehension performance (McCombs & Whisler, 1989). Exploration of the inclusion of other motivational variables seems necessary.

The results of this research also raises some questions about the separability of goal/motive and knowledge as two distinct constructs. As discussed in the measurement section, employment of different measures for the two constructs may reduce their correlations due to measurement methods. It is also possible that reconceptualization of the goal/motive component along the two contrasting achievement goals (i.e., mastery vs. performance goals) may help identify the uniqueness of the construct and thereby lessen its association with the knowledge construct. In other words, although the goal/motive component was found to have powerful influences upon other monitoring components and comprehension monitoring, much work is needed to improve its construct validity.

Finally, it should be pointed out that, as a relatively recent formulation, the model of comprehension monitoring developed in this research is intended to be a general model. It is possible that the relationships among the components may change with different samples and ages (e.g., the influence of goal/motive upon process may be weaker for younger readers than for older readers). From a longitudinal perspective, more knowledge is needed about the ways in which these components work across time. More importantly, given the apparent effect of context (e.g., instructions, task characteristics) on comprehension monitoring and comprehension performance as described in previous chapters, the suggested model of comprehension monitoring should be tested across different contexts (e.g., comprehension monitoring of expository texts vs. narrative passages, spontaneous vs. instructed monitoring, laboratory experiments vs. classroom observations, rich vs. poor content knowledge, etc.), and the context in which the model is tested must be described richly. As Garner (1990) observes, strategic learning cannot be studied fruitfully without assessing the learning situation. The intent of the model of comprehension monitoring is to highlight the complex relationships among monitoring components and comprehension performance; however, the importance of the embedded context is not ignored. Indeed, the importance of addressing the context is a trend emphasized in current psychological and educational research. As Kagan (1992) has pointed out, "one of the most significant changes in psychology, which is affecting all domains of the science, is the recognition that the current constructs for psychological processes should name the particular contexts to which they apply" (p. 991). It is contended that the model of comprehension monitoring tested in this research can be further developed along with a theory of settings that Garner (1990) has suggested.

11.3 Chapter Summary

Summing up, the findings of the present research have offered some support for the model of comprehension monitoring, but further modification and refinement of the conceptualization and measurement of the model components is needed. In addition, there are several other issues that deserve attention, including the use of different samples and age groups, examination of longitudinal development, inclusion of other motivational variables, and consideration of context effects.

REFERENCES

Adams, M. J., & Collins, A. (1979). A schema-theoretic view of reading. In R. O. Freedle (Ed.), *New directions in discourse processing* (Vol. 2, pp. 1-22). Norwood, NJ: Ablex.

Afflerbach, P., & Johnston, P. (1984). Research methodology on the use of verbal reports in reading research. *Journal of Reading Behavior, 16*, 307-322.

Alessi, S., Anderson, T., & Goetz, E. (1979). An investigation of lookbacks during studying. *Discourse Processes, 2*, 197-212.

Alvermann, D. E. (1988). Effects of spontaneous and induced lookbacks on self-perceived high- and low-ability comprehenders. *Journal of Educational Research, 81*, 325-331.

Ames, C., & Arcger, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology, 80*, 260-267.

Anderson, R. C. (1984). Role of the reader's schema in comprehension, learning, and memory. In R. C. Anderson, J. Osborn, & R. J. Tierney (Eds.), *Learning to read in American schools: Basal readers and content texts* (pp. 243-257). Hillsdale, NJ: Erlbaum.

Anderson, T. H. (1980). Study strategies and adjunct aids. In R. J. Spiro, B. C. Bruce, & W. F. Brewer (Eds.), *Theoretical issues in reading comprehension* (pp. 483-502). Hillsdale, NJ: Erlbaum.

August, D. L., Flavell, J. H., & Clift, F. (1984). Comparison of comprehension monitoring of skilled and less skilled readers. *Reading Research Quarterly*, 20, 39-53.

Baker, L. (1979). Comprehension monitoring: Identifying and coping with text confusions. *Journal of Reading Behavior, 11*, 365-374.

Baker, L. (1979). Comprehension monitoring: Identifying and coping with text confusions. *Journal of Reading Behavior, 11*, 365-374.

Baker, L. (1984a). Children's effective use of multiple standards for evaluating their comprehension. *Journal of Educational Psychology, 76*, 588-597.

Baker, L. (1984b). Spontaneous versus instructed use of multiple standards for evaluating comprehension: Effects of age, reading proficiency, and type of standard. *Journal of Experimental Child Psychology, 38*, 289-311.

Baker, L. (1985a). Differences in the standards used by college students to evaluate their comprehension of expository prose. *Reading research Quarterly*, 20, 297-313.

Baker, L. (1985b). How do we know when we don't understand? Standards for evaluating text comprehension. In D. L. Forrest-Pressley, G. E. Mackinnon, & T. G. Waller (Eds.), *Metacognition, cognition, and human performance* (Vol. 1, pp. 155-205). Orlando, FL: Academic Press.

Baker, L. (1989). Metacognition, comprehension monitoring, and the adult reader. *Educational Psychology Review*, 1, 3-38.

Baker, L., & Brown, A. L. (1984a). Cognitive monitoring in reading. In J. Flood (Ed.), *Understanding reading comprehension: Cognition, Language, and the structure of prose* (pp. 21-44). Newark, DE: IRA.

Baker, L., & Brown, A. L. (1984b). Metacognitive skills and reading. In P. D. Pearson (Ed.), *Handbook of reading research* (pp. 353-394). New York: Longman.

Baker, L., & Zimlin, L. (1989). Instructional effects on children's use of two levels of standards for evaluating their comprehension. *Journal of Educational Psychology, 81*, 340-346.

Baldwin, M. J. (1909). How children study. *Archives of Psychology, 12,* 65-70.

Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology.* Cambridge, UK: Cambridge University Press.

Belmont, J. Butterfield, E., & Ferretti, R. (1982). To secure transfer of training instruct self-management skills. In D. K. Detterman & R. Sternberg (Eds.), *How and how much can intelligence be increased?* (pp. 147-154) Norwood, NJ: Ablex.

Berry, W. D., & Feldman, S. (1985). *Multiple regression in practice*. beverly Hills, CA: SAGE Pulications.

Biggs, J. B. (1985). The role of metalearning in study processes. *British Journal of Educational Psychology, 55*, 185-212.

Biggs, J. B. (1987a). *The learning process questionnaire (LPQ): Manual.* Hawthorn, Vic: Australian Council for Educational research.

Biggs, J. B. (1987b). *Student approaches to learning and studying.* Hawthorn, Vic: Australian Council for Educational research.

Boersma, F. J., & Chapman, J. W. (1981). Academic self-concept, achievement expectations, and locus of control in elementary learning-disabled children. *Canadian Journal of Behavioural Science, 13,* 349-358.

Borkowski, J. G. (1992). Metacognitive theory: A framework for teach literacy, writing, and math skills. *Journal of Learning Disabilities, 25,* 253-257.

Borkowski, J. G., Carr, M., & Pressley, M. (1987). "Spontaneous" strategy use: Perspective from metacognitive theoy. *Intelligence*, 11, 61-75.

Borkowski, J. G., Carr, M., Rellinger, E., & Pressley,.M. (1990). Self-regulated cognition: Interdependence of metacognition, attributions, and self-esteem. In B. F. Jones & L. Idol (Eds.), *Dimensions of thinking and cognitive instruction* (pp. 53-92). Hillsdale, NJ: Larence Erlbaum Associates.

Borkowski, J. G. , Day, J. D., Saenz, D., Dietmey, D., Estrada, T. M., & Groteluschen, A. (1992). Expanding the boundaries of cognitive intervention. In B. Y. L. Wong (Ed.), *Contemporary intervention research in learning disabilities: An international perspective.* New York: Springer-Verlag.

Borkowski, J. G., Weyhing, R. S. , Carr, M. (1988). Effects of attributional retraining on strategy-based reading comprehension in learning-disabled students. *Journal of Educational Psychology*, 80, 46-53.

Bos, C. S., & Filip, D. (1984). Comprehension monitoring in learning disabled and average students. *Journal of Learning Disabilities, 17*, 229-232.

Bowey, J. A. (1986). Syntactic awareness in relation to reading skill and ongoing reading comprehension monitoring. *Journal of Experimental Child Psychology, 41*, 282-299.

Brown, A. L. (1974). The role of strategic behavior in retarded memory. In N. R. Ellis (Ed.), *International review of research in mental retardation* (Vol. 7, pp. 55-113). New York: Academic Press.

Brown, A. L. (1978). Knowing when, where, and how to remember: A problem in metacognition. In R. Glasser (Ed.), *Advances in instructional psychology* (Vol. 1, pp. 77-165). Hillsdale, NJ: Erlbaum.

Brown, A. L. (1980). Metacognitive development and reading. In R. J. Spiro, B. C. Bruce, & W. F. Brewer (Eds.), *Theoretical issues in reading comprehension* (pp. 453-481). Hillsdale, NJ: Erlbaum.

Brown, A. L. (1981). Metacognition: The development of selective attention strategies for learning from texts. In M. L. Kamil (Ed.), *Directions in reading: Research and instruction* (pp. 21-43). Washington, DC: The National Reading Conference.

Brown, A. L., Armbruster, B. B., & Baker, L. (1986). The role of metacognition in reading and studying. In J. Orasanu (Ed.), *Reading comprehension: From research to practice* (pp. 49-75). Hillsdale, NJ: Erlbaum.

Brown, A. L., Bransford, J. D., Ferrara, R. A., & Campione, J. C. (1983). Learning, remembering, and understanding. In J. H. Flavell & E. M. Markman (Eds.), *Handbook of child psychology* (Vol. 3, pp. 77-166). New York: Wiley.

Butkowsky, I. S., & Willows, D. M. (1980). Cognitive-motivational characteristics of children varying in reading ability: Evidence for learned helplessness in poor readers. *Journal of Educational Psychology, 72*, 408-422.

Calamai, P. (1987). *Broken words: Why five million Canadians are illiterate* (The Southam literacy report). Toronto: Southam Newspaper Group.

Campione, J. C. , & Brown, A. L. (1977). Memory and metamemory development in educable retarded children. In R. V. Kail, Jr. & J. W. Hagen (Eds.), *Perspectives on the development of memory and cognition* (pp. 367-405). Hillsdale, NJ: Erlbaum.

Canney, G., & Winograd. P. (1979). *Schemata for reading and reading comprehension performance* (Tech. Report No. 120). Champaign, IL: University of Illinois, Center for the Study of Reading.

Carr, M., & Borkowski, J. G. (1989). Attribution training and the generalization of reading strategies with underachieving children. *Leaning and Individual Differences, 1*, 327-341.

Carr, M., Borkowski, J. G., & Maxwell, S. E. (1991). Motivational components of underachievement. *Developmental Psychology*, 27, 108-118.

Cavanaugh, J. C., & Perlmutter, M. (1982). Metamemory: A critical examination. *Child Development, 53,* 11-28.

Chan, L. K. S., Cole, P. G., & Barfett, S. (1987). Comprehension monitoring: Detection and identification of text inconsistencies by LD and normal students. *Learning Disability Quarterly, 10,* 114-124.

Clay, M. M. (1973). *Reading: The patterning of complex behavior.* Auckland, NZ: Heinemann.

Cook, V. A., & Keith, T. Z. (1991). Testing a model of school learning: Direct and indirect effects on academic achievement. *Contemporary Educational Psychology*, 16, 28-24.

Dewey, J. (1910). *How we think.* Boston: Heath.

Downing, J. , & Leong, C. K. (1982). *Psychology of reading.* New York: Macmillan.

Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist, 41*, 1040-1048.

Dweck, C. S., & Bempechat, J. K. (1983). Children's theories of intelligence: Consequences for learning. In S. G. Paris, G. M. Olson, & H. W. Stevenson (Eds.), *Learning and motivation in the classroom* (pp. 239-256). Hillsdale, NJ: Erlbaum.

Ericsson, K., & Simon, H. (1980). Verbal reports as data. *Psychological Review, 87,* 215-251.

Ericsson, K., & Simon, H. (1984). *Protocol analysis: Verbal reports as data.* Cambridge, MA: MIT Press.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *American Psychologist, 34*, 906-911.

Flavell, J. H. (1981). Cognitive monitoring. In W. P. Dickson (Ed.), *Children's oral communication skills* (pp. 35-60). New York: Academic Press.

Flavell, J. H. (1984). Cognitive development during the postinfancy years. In K. Gleason (Ed.), *Issues in cognition: Proceedings of a joint conference in psychology* (pp. 1-17). Washington, DC: National Academy of Sciences.

Flavell, J. H. (1985). *Cognitive development* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Flavell, J. H., Speer, J. R., Green, F. L., & August, D. L. (1981). *The development of comprehension monitoring and knowledge about communication.* Monographs of the Society for Research in Child Development, 46 (5, Serial No. 192).

Forrest-Pressley, D., & Waller, T. G. (1984). *Cognition, metacognition, and reading.* New York: Springer-Verlag.

French, F. F. (1985). *Cognitive strategy assessment and intervention with educable mentally handicapped adolescents.* Unpublished doctoral dissertation, University of Alberta.

Fry, P. S., & Lupart, J. L. (1987). *Cognitive processes in children's learning: Practical applications in educational practice and classroom management.* Springfield, Ill.: Charles C. Thomas.

Gambrell, L. B., & Heatington, B. S. (1981). Adult disabled readers' metacognitive awareness about reading tasks and strategies. *Journal of Reading Behavior, 13*, 215-222.

Garner, R. (1980). Monitoring of understanding: An investigation of good and poor readers' awareness of induced miscomprehension of text. *Journal of Reading Behavior, 12*, 55-64.

Garner, R. (1981). Monitoring of passage inconsistency among poor comprehenders: A preliminary text of the "piecemeal processing" explanation. *Jounral of Educational Research, 74*, 159-162.

Garner, R. (1982). Verbal-report data on reading strategies. *Journal of Reading Behavior, 14*, 159-167.

Garner, R. (1987). *Metacognition and reading comprehension.* Norwood, NJ: Ablex.

Garner, R. (1988). Verbal-report data on cognitive and metacognitive strategies. In C. E. Weinstein, E. T. Goetz, & P. A. Alexander (Eds.), *Learning and study strategies: Issues in assessment, instruciton, and evaluation* (pp. 63-76). San Diego, CA: Academic Press.

Garner, R. (1990). When children and adults do not use learning strategies: Toward a theory of settings. *Review of Educational Research, 60*, 517-529.

Garner, R., & Alexander, P. (1982). Strategic processing of text: An investigation of the effect on adults' question-answering performance. *Journal of Educational Research, 75*, 144-148.

Garner, R., & Alexander, P. (1989). Metacognition: Answered and unanswered questions. *Educational Psychologist, 24*, 143-158.

Garner, R., & Alexander, P. A., & Hare, V. C. (1991). Reading comprehension failure in children. In B. Y. L. Wong (Ed.), Learning about learning disabilities (pp. 281-305). San Diego, CA: Academic Press.

Garner, R., & Anderson, J. (1981-1982). Monitoring-of-understanding research: Inquiry directions, methodological dilemmas. *Journal of Experimental Education, 50*, 70-76.

Garner, R., Hare, V. C., Alexander, P., Haynes, J., & Winograd, P. (1984). Inducing use of a text lookback strategy among unsuccessful readers. *American Educational Research Journal, 21*, 789-798.

Garner, R., & Kraus, C. (1981-1982). Good and poor comprehender differences in knowing and regulating reading behaviors. *Educational Research Quarterly, 6*, 5-12.

Garner, R., Macready, G. B., & Wagoner, S. (1984). Readers' acquisition of the components of the text-lookback strategy. *Journal of Educational Psychology, 76*, 300-309.

Garner, R., & Reis, R. (1981). Monitoring and resolving comprehension obstacles: An investigation of spontaneous text lookbacks among upper-grade good and poor comprehenders. *Reading Research Quarterly, 16*, 569-582.

Garner, R., & Taylor, N. (1982). Monitoring of understanding: An investigation of attentional assistance needs at different grade and reading proficiency levels. *Reading Psychology, 3*, 1-6.

Garner, R., Wagoner, S., & Smith, T. (1983). Externalizing question-answering strategies of good and poor comprehenders. *Reading Research Quarterly, 18*, 439-447.

Gibson, E. J., & Levin, H. (1975). *The psychology of reading*. Cambridge, MA: MIT Press.

Glenberg, A. M., Wilkinson, A. C., & Epstein, W. (1982). The illusion of knowing: Failure in the self-assessment of comprehension. *Memory and Cognition, 10*, 597-602.

Goodman, K. S. (1970). Reading: A psycholinguistic guessing game. In H. Singer & R. B. Ruddel (Eds.), *Theoretical models and processes of reading* (1st ed., pp. 259-271). Newark, DE: IRA.

Goodman, K. S. (1976). Behind the eye: What happens in reading. In H. M. Singer, & R. B. Ruddell (Eds.), *Theoretical models and processes of reading* (2nd ed., pp. 470-496). Newark, DE: IRA.

Gottfried, A. E. (1985). Academic intrinsic motivation in elementary and junior high school students. *Journal of Educational Psychology*, 77, 631-645.

Gough, P. B. (1972). One second of reading. In J. F. Kavanagh & E. G. Mattingly (Eds.), *Language by ear and by eye* (pp. 331-358). Cambridge, MA: MIT Press.

Gough, P. B., & Cosky, M. J. (1977). One second of reading again. In N. Castellan, P. John, B. David, & G. R. Potts (Eds.), *Cognitive theory* (Vol. 2). Hillsdale, NJ: Erlbaum.

Grabe, M., Antes, J., Kahn, H., & Kristjanson, A. (1991).Adult and adolescent readers' comprehension monitoring performance: An investigation of monitoring acuracy and related eye movements. *Contemporary Educational Psychology, 16*, 45-60.

Grabe, M., Antes, J., Thorson, I., & Hahn, H. (1987). Eye fixation patterns during informed and uninformed comprehension monitoring. *Journal of Reading Behavior, 19*, 123-140.

Gross, T. F. (1985). *Cognitive development*. Monterey, CA.: Brooks/Cole.

Hahn, A., & Smith, T. (1983). Students' differentiation of reader-based and text-based questions. *Journal of Educational Research, 76*, 331-334.

Haenggi, D., & Perfetti, C. A. (1992). Individual differences in reprocessing of text. *Journal of Educational Psychology*, 84, 182-192.

Hare, V. C., & Pulliam, C. A. (1980). College students' metacognitive awareness of reading behaviors. In M. L. Kamil & A. J. Moe (Eds.), *Perspectives on reading research and instruction* (pp. 226-231). Washington, DC: National Reading Conference.

Hare, V. C., & Smith, D. C. (1982). Reading to remember: Studies of metacognitive reading skills in elementary school-aged children. *Journal of Educational Research, 75,* 157-164.

Hiebert, E. H., Winograd, P. N., & Danner, F. W. (1984). Children's attributions of failure and success for different aspects of reading. *Journal of Educational Psychology, 76*, 1139-1148.

Holt, J. C. (1964). *How children fail.* New York: Pitman.

Hosseini, J., & Ferrell, W. R. (1982). Measuring metacognition in reading by detectability of cloze accuracy. Journal of Reading Behavior, 14, 263-274.

Huey, E. B. (1908/1968). *The psychology and pedagogy of reading.* Cambridge, MA: M.I.T. Press.

Hutchinson, N. L. (1992). The challenges of componential analysis: cognitive and metacognitive instruction in mathematical problem solving. *Journal of Learning Disabilities, 25*, 249-252, 257.

Jacobs, J. E., & Paris, S. G. (1987). Children's metacognition about reading: Issurs in definition, measurement, and instruction. *Educational Psychologist*, 33, 255-278.

James, W. (1890). *Principles of psychology,* Vol. 1. New York: Holt. (Republished by Dover, 1950).

Johgsma, E. A. (1980). Cloze instruction research: A second look. Newark, DE: International Reading Association.

Johnston, P. H., & Winograd, P. N. (1985). Passive failure in reading. *Journal of Reading Behavior, 17*, 279-301.

Kagan, J. (1992). Yesterday's premises, tomorrow's promises. *Developmental Psychology*, 28, 990-997.

Kant, E. (1787). *Critique of pure reason* (K. Smith, Trans., 1963). London: Macmillan.

Kavale, K. & Shreiner, R. (1979). The reading process of above average and average readers: A comparison of the use of reasoning strategies in responding to standardized comprehension measures. *Reading Research Quarterly, 15*, 102-128.

Keith, T. Z. (1988a). Path analysis: An introduction for school psychologists. *School Psychology Review, 17*, 343-362.

Keith, T. Z. (1988b). Using path analysis to text the importance of manipulable influences on school learning. *School Psychology Review, 17*, 637-643.

Kerlinger, F. N. (1979). *Behavioral research: A conceptual approach.* New York: Holt, Rinehart and Winston

Kirby, J. R. (1984). Strategies and processes. In J. R. Kirby (Ed.), *Cognitive strategies and educational performance* (pp. 3-12). New York: Academic Press.

Kirby, J. R., & Moore, P. J. (1987). Metacognitive awareness about reading and its relation to reading ability. *Journal of Psychoeducational Assessment, 5*, 119-137.

Kreutzer, M. A., Leonard, C., & Flavell, J. H. (1975). An interview study of children's knowledge about memory. *Monographs of the Society for Research in Child Development, 40* (1, Serial No. 159).

Kurtz, B. E., & Borkowski, J. G. (1984). Children's metacognition: Exploring relations among knowledge, process, and motivational variables. *Journal of Experimental Child Psychology, 37*, 335-354.

LaBerge, D., & Samuels, S. J. (1974). Toward a theory of automatic information processing in reading. *Cognitive Psychology, 6*, 293-323.

Lehman, R. S. (1991) *Statistics and research design in the behavioral sciences.* Belmont, CA: Wadsworth.

Lawson, M. J. (1984). Being executive about metacognition. In J. R. Kirby (Ed.), *Cognitive strategies and educational performance* (pp. 89-109). New York: Academic Press.

Leong, C. K. (1974). *An investigation of spatial-temporal information-processing in children with specific reading disability.* Unpublished doctoral dissertation, University of Alberta.

Lesgold, A. M., & Perfetti, C. A. (1978). Interactive processes in reading comprehension. *Discourse Processes, 1*, 323-326.

Licht, B. G. (1983). Cognitive-motivational factors that contribute to the achievement of learning-disabled children. *Journal of Learning Disabilities, 16*, 483-490.

Lupart, M. E. (1984). *Strategic intervention and reading comprehension monitoring.* Unpublished doctoral dissertation, University of Alberta.

Lupart, J. L. (1981). *Attention and disabled readers: A top-down approach.* Unpublished doctoral dissertation, University of Alberta.

Mangano, N. G., Palmer, D., & Goetz, E. T. (1982). Improving reading comprehension through metacognitive training. *Reading Psychology*, 3, 365-374.

Markman, E. M. (1977). Realizing that you don't understand: A preliminary investigation. *Child Development, 48*, 986-992.

Markman, E. M. (1979). Realizing that you don't understand: Elementary school children's awareness of inconsistencies. *Child Development*, 50, 643-655.

Markman, E. M. (1981). Comprehension monitoring. In W. P. Dickson (Ed.), *Children's oral communication skills* (pp. 61-84). New York: Academic Press.

Markman, E. M. (1985). Comprehension monitoring: Developmental and educational issues. In S. F. Chipman, J. W. Segal, & R. Glaser (Eds.), *Thinking and learning skills* (Vol. 2, pp. 275-291). Hillsdale, NJ: Erlbaum.

Markman, E. M., & Gorin, L. (1981). Children's ability to adjust their standards for evaluating comprehension. *Journal of Educational Psychology*, 73, 320-325.

Marsh, H. W. (1986). Self-serving effect (bias?) in academic attributions: Its relation to academic achievement and self-concept. *Journal of Educational Psychology, 78*, 190-200.

Marsh, H. W., Cairns, L., Relich, J., Barnes, J., & Debus, R. L. (1984). The relationship between dimensions of self-attribution and dimensions of self-concept. *Journal of Educational Psychology, 76* , 3-32.

McCombs, B. L., & Whisler, J. S. (1989). The role of affective variables in autonomous learning. *Educational Psychologist, 24,* 277-306.

Meichenbaum, D., & Biemiller, A. (1992). In search of student expertise in the classroom: A metacognitive analysis. In M. Pressley, K. R. Harris, & J. T. Guthrie (Eds.), *Promoting academic competence and literacy in school.* San Diego, CA: Academic Press.

Meichenbaum, D., Burland, S., Gruson, L., & Cameron, R. (1985). Metacognitive assessment. In S. R. Yussen (Ed.), *The growth of reflection in children* (pp. 3-35). Orlando,FL: Academic Press.

Miller, P. H., & Bigi, L. (1979). The development of children's understanding of attention. *Merrill-Palmer Quarterly, 25,* 235-250.

Mize, J. (1980). The relationship between reading performance and awareness of comprehension of textbook passages. In M. L. Kamil & A. J. Moe (Eds.), *Perspectives on reading research and instruction* (pp. 34-37). Washington, DC: National Reading Conference.

Montague, M. (1992). The effects of cognitive and metacognitive strategy instruction on the mathematical problem solving of middle school students with learning disabilities. *Journal of Learning Disabilities, 25,* 230-248.

Moore, P. J. (1983). Aspects of metacognitive knowledge about reading. *Journal of Research in Reading, 6*, 87-102.

Moore, P., & Kirby, J. (1981). Metacognition and reading performance: A replication and extension of Myers and Paris in an Australian context. *Educational Enquiry, 4*, 18-29.

Mulcahy, R. F. (1991). Developing autonomous learners. *Alberta Journal of Educational Research*, 37, 385-397.

Mulcahy, R. F. , Peat, D., Andrews, J., Clifford, L., Marfo, K., & Cho, S. (1989). *Cognitive education final report.* Edmonton, AB: Alberta Education.

Myers, M., & Paris, S. G. (1978). Children's metacognitive knowledge about reading. *Journal of educational Psychology, 70*, 680-690.

Neisser, U. (1967). *Cognitive psychology.* New York: Appleton-Century-crofts.

Neyrinck, M. J. (1986). A comparative study of good and poor sixth-grade readers' concepts of reading, conceptual prior knowledge, and reading comprehension of narrative and expository text. Unpublished doctoral dissertation, University of Alberta.

Nicholls, J. G. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review, 91*, 328-346.

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review, 84*, 231-259.

Olshavsky, J. E. (1976-1977). Reading as problem solving: An investigation of strategies. *Reading Research Quarterly, 12*, 654-675.

Olshavsky, J. E. (1978). Comprehension profiles of good and poor readers across material of increasing difficulty. In P. D. Pearson & J. Hansen (Eds.), *Reading: Disciplined inquiry in process and practice* (pp. 73-76). Clemson, SC: National Reading Conference.

Palincsar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction, 1*, 117-175.

Palincsar, A. S., Brown, A. L., & Martin, S. (1987).Peer interaction reading comprehension instruction. *Educational Psychologist, 22*, 231-253.

Paris, S. G. (1991). Assessment and remediation of metacognitive aspects of children's reading comprehension. *Topics in Language Disorders, 12*(1), 32-50.

Paris, S. G., & Jacobs, J. E. (1984). The benefits of informed instruction for children's reading awareness and comprehension skills. *Child Development, 55*, 2083-2093.

Paris, S. G., Lipson, M. Y., & Wixson, K. K. (1983). Becoming a strategic reader. *Contemporary Educational Psychology, 8*, 293-316.

Paris, S. G., & Myers, M. (1981). Comprehension monitoring, memory, and study strategies of good and poor readers. *Journal of Reading Behavior, 13*, 5-22.

Paris, S. G., & Oka, E. R. (1986). Children's reading stratefgies, metacognition, and motivation. *Developmental Review*, 6, 25-56.

Paris, S. G., Wasik, B. A., & Turner, J. C. (1991). The development of strategic readers. In R. Barr, M. L. Kamil, P. B. Mosenthal, & P. D. Pearson (Eds.), *Handbook of reading research*, Vol. 2 (pp. 609-640). White Plains,NY: Longman.

Paris, S. G., Wasik, B. A., & van der Westhuizen, G. (1988). Meta-metacognition: A review of research on metacognition and reading. In J. Readance & S. Baldwin (Eds.), *Dialogues in literacy research*, (pp. 143-166). Chicago, IL: National Reading Conference, Inc..

Paris, S. G., & Winograd, P. (1990). How metacognition can promote academic learning and instruction. In B. F. Jones & L. Idol (Eds.), *Dimensions of thinking and cognitive instruction* (pp. 15-52). Hillsdale, NJ: Larence Erlbaum Associates.

Pearl, R., Bryan, T., & Donahue, M. (1980). Learning disabled children's attributions for success and failure. *Learning Disability Quarterly, 3*, 3-9.

Pearl, R., Bryan, T., & Herzong, A. (1983). Learning disabled and nondisabled children's strategy analyses under high and low success conditions. *Learning Disability Quarterly, 6*, 67-74.

Perfetti, C. A. (1985). *Reading Ability*. New York: Oxford University Press.

Perfetti, C. A., & Lesgold, A. M. (1977). Discourse comprehension and sources of individual differences. In P. Carpenter & M. Just (Eds.), *Cognitive processes in comprehension* (pp. 141-183). Hillsdale, NJ: Erlbaum.

Perfetti, C. A., & Lesgold, A. M. (1979). Coding and comprehension in skilled reading and implications for reading instruction. In L. B. Resnick & P. A. Weaver (Eds.), *Theory and practice of early reading* (vol. 1, pp. 57-84). Hillsdale, NJ Erlbaum.

Piaget, J. (1926). *The language and thought of the child*. New York: Harcourt, Brace.

Pressley, M., & Ghatala, E., S. (1988). Delusions about performance on multiple-choice comprehension tests. *Reading Research Quarterly, 23*, 454-464.

Pressley, M., & Ghatala, E., S. (1990). Self-regulated learning: Monitoring learning from text. *Educational Psychologist, 25*, 19-33.

Pressley, M., & Ghatala, E., S., Woloshyn, V., & Pirie, J. (1990). Sometimes adults miss the main ideas and do not realize it: Confidence in responses to short-answer and multiple-choice comprehension questions. *Reading Research Quarterly, 25*, 232-249.

Rankin, E. F. (1959). The cloze procedure -- its validity and utility. In O. S. Causey & W. Eller (Eds.), *Starting and improving college reading programs: Eighth yearbook of the national reading conference* (pp. 131-144). Fort Worth, TX: National Reading Conference.

Rankin, E. F., & Helm, P. (1986). The validity of cloze tests in relation to a psycholinguistic conceptualization of reading comprehension. *Forum for Reading, 17*, 46-59.

Raykovicz, M. L., Bromley, K., & Mahlois, M. (1985). The reading task as viewed by good and poor readers. *Reading Improvement, 22*, 87-91.

Reeve, R. A., & Brown, A. L. (1985). Metacognition reconsidered: Implications for intervention research. *Journal of Abnormal Child Psychology, 13(* 343-356.

Reid, M. K., & Borkowski, J. G. (1987). Causal attributions of hyperactive children: Implications for teaching strategies and self-control. *Journal of Educational Psychology, 79*, 296-307.

Relich, J. D., Debus, R. L., & Walker, R. (1986). The mediating role of attribution and self-efficacy variables for treatment effects on achievement outcomes. *Contemporary Educational Psychology, 11*, 195-216.

Resnick, L. B. (1981). Instructional psychology. *Annual Review of Psychology, 32*, 659-704.

Revelle, G. L., Wellman, H. M., & Karabenick, J. D. (1985). Comprehension monitoring in preschool children. *Child Development, 56*, 654-663. [Cited in Garner, R. (1987). *Metacognition and reading comprehension* (pp. 92-93). Norwood, NJ: Ablex.]

Rothkopf, E. Z., & Billington, M. J. (1979). Goal-guided learning from text: Inferring a descriptive processing model from inspection times and eye movements. *Journal of Educational Psychology, 71*, 310-327.

Rumelhart, D. E. (1977). Toward an interactive model of reading. In S. Dornic (Ed.), *Attention and performance* (Vol. 6, pp. 573-603). Hillsdale, NJ: Erlbaum.

Rumelhart, D. E. (1980). Schemata: The building blocks of cognition. In R. J. Spiro, B. C. Bruce, & W. F. Brewer (Eds.). *Theoretical issues in reading comprehension* (pp.33-58). Hillsdale, NJ: Erlbaum.

Rumelhart, D. E., & McCleland, J. L. (1981). Interactive processing through spreading activation. In A. M. Lesgold & C. A. Perfetti (Eds.), *Interactive processes in reading* (pp.37-60). Hillsdale, NJ: Erlbaum.

Rumelhart, D. E., & Ortony, A. (1977). The representation of knowledge in memory. In R. C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), *Schooling and the acquisition of Knowledge* (pp. 99-135). Hillsdale, NJ: Erlbaum.

Ryan, E. B. (1981). Identifying and remediating failures in reading comprehension: Toward an instructional approach for poor comprehenders. In G. E. Mackinnon & T. G. Waller (Eds.), *Reading research: Advances in theory and practice* (Vol. 3, pp.223-261). New York: Academic Press.

Ryan, E. B., Ledger, G. W., Short, E. J., & Weed, K. A. (1982). Promoting the use of active comprehension strategies by poor readers. *Topics in Learning and Learning Disabilities, 2*, 53-60.

Samuels, S. J. (1977). Introduction to theoretical models of reading. In W. Otto, N. A. Peters & C. W. Peters (Eds.), *Reading problems, A multidisciplinary perspective* (pp. 7-41). Reading, MA.: Addison-Wesley.

Schmidt, W. H. O. (1973). *Child development: The human, cultural, and educational context.* New York: Harper & Row.

Schneider, W., Korkel, J., & Weinert, F. E. (1987). The effects of intelligence, self-concept, and attributional style on metamemory and memory behavior *International Journal of Behavioal Development, 10,* 281-299.

Schneider, W., Korkel, J., & Weinert, F. E. (1990). Expert knowledge, general abilities, and text processing. In W. Schneider & F. E. Weinert (Eds.), *Interactions among aptitudes, strategies, and knowledge in cognitive performance* (pp. 235-252). New York: Springer-Verlag.

Shanahan, T., Kamil, M. L., & Tobin, A. (1982). Cloze as a measure of intersentential comprehension. Reading *Research Quarterly, 17,* 229-255.

Short, E. J., & Weissberg-Benchell, I. A. (1989). The triple alliance for learning: Cognition, metacognition, and motivation. In C. B. McCormick, G., Miller, & M. Pressley (Eds.), *Cognitive strategy research: From basic research to educational application* (pp.33-63). New York: Springer-Verlag.

Sivan, E. , & Roehler, L. (1986). Motivational statements in explicit teacher explanations and their relationship to students' metacognition in reading. *National Reading Conference Yearbook,* 35, 178-184.

Skinner, B. F. (1987). What happened to psychology as the science of behavior? *American Psychologist, 42,* 780-786.

Slife, B. D., Weiss, J., & Bell, T. (1985). Separability of metacognition and cognition: Problem solving in learning disabled and regular students. *Journal of Educational Psychology, 77,* 437-445.

Snowman, J. (1986). Learning tactics and strategies. In G. D. Phye & T. Andre (Eds.), *Cognitive classroom learning: Understand, thinking, and problem solving* (pp. 243-275). New York: Academic Press.

Joreskog, K. G., & Sorbom, D. (1986). *LISREL VI: Analysis of linear structural relationships by maximum likelihood, instrumental variables, and least squares methods.* Mooresvill, IN: Scientific Software.

Stanovich, K. E. (1980). Toward an interactive-compensatory model of individual differences in development of reading fluency. *Reading Research Quarterly, 16,* 32-71.

Sternberg, R. J. (1977). *Intelligence, information processing, and analogical reasoning: The componential analysis of human abilities.* Hillsdale, NJ: Erlbaum.

Sternberg, R. J. (1984). What should intelligence tests test? Implications of a triarchic theory of intelligence for intelligence testing. *Educational Research, 13,* 5-15.

Tabachnick, B. G., Fidell, L. S. (1989). *Using multivariate statistics* (2nd ed.). New York: Harper & Row.

Taylor, W. (1953). Cloze procedure: A new tool for measuring readability. *Journalism Quarterly,* 30, 415-433.

Taylor, W. (1957). Cloze readability scores as indices of individual differences in comprehension and aptitude. *Journal of Applied Psychology, 41,* 19-26.

Thorndike, E. L. (1917). Reading as reasoning: A study of mistakes in paragraph reading. *Journal of Educational Psychology, 8,* 323-332.

Vosniadou, S., Pearson, P. D., & Rogers, T. (1988). What causes children's failures to detect inconsistencies in text ? Representation versus comparison difficulties. *Journal of Educational Psychology*, 80, 27-29.

Wagner, D. A., Spratt, J. E., Gal, I., & Paris, S. G. (1989). Reading and believing: Beliefs, attributions, and reading achievement in Moroccan schoolchildren. *Journal of Educational Psychology*, 81, 283-293.

Wagoner, S. A. (1983). Comprehension monitoring: What it is and what we know about it. *Reading Research Quarterly, 18*, 328-346.

Weiner, B. (1979). A theory of motivation for some classroom experiences. *Journal of Educational Psychology, 71*, 3-25.

Weiner, B. (1983). Some methodological pitfalls in attributional research. *Journal of Educational Psychology, 75*, 530-543.

Weinert, F. E. (1987). Introduction and overview: Metacognition and motivation as determinants of effective learning and understanding. In F. E. Weinert & R. H. Kluwe (Eds.). (1987). *Metacognition, motivation, and understanding* (pp. 1-16). Hillsdale, NJ: Erlbaum.

Weinert, F. E., & Kluwe, R. H. (Eds.). (1987). *Metacognition, motivation, and understanding*. Hillsdale, NJ: Erlbaum.

Wessells, M. G. (1982). *Cognitive Psychology*. New York: Harper & Row.

Whimbey, A. (1975). *Intelligence can be taught*. New York: Dutton.

White, P. (1980). Limitations on verbal reports of internal events: A refutation of Nisbett and Wilson and of Ruddel. *Psychological Review, 87*, 105-112.

Winne, P. H., Woodlands, M. J., & Wong, B. Y. L. (1982). Comparability of self-concept among learning disabled, normal and gifted students. *Journal of Learning disabilities, 15*, 470-475.

Winograd, P. N., & Johnston, P. (1982). Comprehension monitoring and the error detection paradigm. *Journal of reading Behavior, 14*, 61-76.

Wingrad, P. N., & Niquette, G. (1988). Assessing learned helplessness in poor readers. *Topics in Language Disorders, 8*(3), 38-55.

Zabrucky, K. (1990). Evaluation of understanding in college students: Effects of text structure and reading proficiency. *Reading Research and Instruction. 29* (4), 46-54.

Zabrucky, K., & Moore (1991). Effects of skill on standard used by younger and older adults to evaluate understanding. *Reading Psychology*, *12*, 147-158.

Zabrucky, K., Moore, D., & Ratner, H. H. (1985). Comprehension monitoring in good and poor readers: Evidence from verbal and performance measures. *Reading Psychology, 6,* 241-250.

Zabrucky, K., Moore, D., & Schultz, N. R. (1987). Evaluation of comprehension in young and old adults. *Developmental Psychology, 23*, 39-43.

Zabrucky, K., & Ratner, H. H. (1986). Children's comprehension monitoring and recall of inconsistent stories. *Child Development, 57*, 1401-1418.

Zabrucky, K., & Ratner, H. H. (1989). Effects of reading ability on children's evaluation and regulation. *Journal of Reading Behavior, 21*, 69-83.

Appendices

Appendix A

Stem and Leaf Displays of Data
of Six Sample Characteristics
(CA, Non-Verbal IQ, Verbal IQ, Full IQ, Comp., & Vocab.)

Less Skilled Readers   Skilled Readers

Age

```
                                             Frequency    Stem &  Leaf
 Frequency    Stem &  Leaf
                                                 1.00 Extremes    (130)
     2.00       12 .  99                          .00       13 *
    14.00       13 *  00112233333444             3.00       13 t  233
     8.00       13 .  57888899                   1.00       13 f  5
     6.00       14 *  000012                     5.00       13 s  66677
                                                 8.00       13 .  88888999
                                                 8.00       14 *  00001111
                                                 3.00       14 t  222
```

Lorge-Thorndike Non-Verbal IQ

```
 Frequency    Stem &  Leaf                  Frequency    Stem &  Leaf

     4.00        9 *  2344                      4.00        9 *  2244
     6.00        9 .  678899                    2.00        9 .  88
     4.00       10 *  1244                      5.00       10 *  23444
     8.00       10 .  56778899                  6.00       10 .  688999
     5.00       11 *  00134                    10.00       11 *  0001233444
     3.00       11 .  555                       2.00       11 .  55
```

Lorge-Thorndike Verbal IQ

```
 Frequency    Stem &  Leaf                  Frequency    Stem &  Leaf

     6.00        9 *  011244                    6.00       10 *  222334
     8.00        9 .  56778899                  5.00       10 .  55669
    11.00       10 *  00002333444              11.00       11 *  00011222334
     3.00       10 .  999                       6.00       11 .  555568
     2.00       11 *  01                        1.00       12 *  1
```

Note: Stem width: 10   Each leaf: 1 case

Less Skilled Readers **Skilled Readers**

Lorge-Thorndike Full IQ

```
Frequency    Stem &  Leaf            Frequency    Stem &  Leaf

   2.00        9  *  22                 2.00 Extremes     (97), (98)
   9.00        9  .  667788889          2.00        9  .  99
   7.00       10  *  0111234            1.00       10  *  1
   8.00       10  .  55699999          10.00       10  .  5777778889
   4.00       11  *  0002              13.00       11  *  0012223344444
                                        1.00       11  .  5
```

CTBS Comprehension

```
Frequency    Stem &  Leaf            Frequency    Stem &  Leaf

   1.00        0  *  3                  5.00        7  *  44444
   3.00        0  .  588                3.00        7  .  777
   5.00        1  *  11113              5.00        8  *  00333
   8.00        1  .  57779999           9.00        8  .  555555799
   4.00        2  *  2222               6.00        9  *  022334
   9.00        2  .  555579999          1.00        9  .  7
```

CTBS Vocabulary

```
Frequency    Stem &  Leaf            Frequency    Stem &  Leaf

   6.00        0  .  333557             1.00 Extremes     (41)
   8.00        1  .  03337799           1.00        5  .  7
   3.00        2  .  558                 .00        6  *
   5.00        3  .  14888              5.00        6  .  58888
   3.00        4  .  111                3.00        7  *  111
   2.00        5  .  00                 4.00        7  .  7999
   2.00        6  .  58                 6.00        8  *  444444
   1.00        7  .  7                  2.00        8  .  66
                                        2.00        9  *  00
                                        5.00        9  .  55566
```

Note: Stem width: 10 Each leaf: 1 case

Appendix B

Table of Hotelling T^2 Test
for Data of Six Sample Characteristics
(CA, Non-Verbal IQ, Verbal IQ, Full IQ, Comp., & Vocab.)

Mahalanobis D Square = 87.664

T^2 = 1.22.667 DF1 = 6 DF2 = 52

F-ratio = 196.546 P = 0.000

Tests for each variable with multivariate degrees of freedom

Variable	T^2	DF1	DF2	F	P
Chronological Age	9.067	6	52	1.379	0.241
Non-Verbal IQ	1.092	6	52	0.166	0.985
Verbal IQ	46.387	6	52	7.053	0.000
Full IQ	16.759	6	52	2.548	0.031
Comprehension	1206.657	6	52	183.468	0.000
Vocabulary	132.736	6	52	20.182	0.000

Appendix C

Metacognitive Interview Items

1. What do you like about reading? Why?
2. What, if anything, do you dislike about reading? Why?
3. Are there times when you think of yourself as a "good" reader? Explain.
4. Are there times when you think of yourself as a "poor" reader? Explain
5. Please complete the following sentence: When I read, I try to ....
6. What would help you become a better reader?
7. Do you think children your age read as well as adults? Why?
8. Suppose there were two boys named John and Alan who came from different homes. John's parents were rich and John had lots of toys and books. Alan's parents were poor and didn't have many books at home. Do you think one of these boys was a better reader at school? Which one? Why?
9. The other day I talked to a boy/girl who was really good at arithmetic. Do you think he/she was also a good reader? Why?
10. What makes someone a really good reader?
11. What does the first sentence usually do for a paragraph or story ?
12. What does the last sentence do (for a story or a paragraph)?
13. I asked a girl named Joan to read a story that was five pages long, and a girl named Mary to read a story that was two pages long. Which girl took longer to read her story?Why?
14. If I asked you to read a story/passage really fast and you could only read some sentences, which ones would you try to read? Why?
15. What makes something difficult to read?
16 When you're reading, what do you do if there's a word you don't understand?
17. What do you do if you don't understand a whole sentence?
18. When you read a story,how can you know you're reading it well?
19. When you're reading, do you ever make up pictures in your head? Why?
20. Do you ever have to go back and read things over? Why?

Appendix D

Metacognitive Interview Scoring Scale

No.	Code	Score	Scheme	Example
1.	like	0	lack of interest	don't like reading, boring.
		1	passive, negative	So don't have to do chores
		2	passive, positive	good way to pass time
		3	active, affect only	fun, interesting, exciting
		4	active, affect+knowledge	fun, know more about world
2.	dislike	0	lack of interest	boring, hate reading
		1	reading as decoding	reading aloud. big words
		2	feeling, affect only	scary stories, science
		3	high interest	enjoy reading most time
		4	reading as comprehension	poorly written stories
3.	self good reader	0	lack of self-esteem	always poor reader
		1	reading as decoding	know big words
		2	speed, fluency	read fast, smoothly
		3	concentration, involvement	get into the book
		4	reading as comprehension	understand what is read
4.	self poor reader	0	lack of self-esteem	read choppy
		1	reading as decoding	don't know big words
		2	general high self-esteem	always good reader
		3	effort, concentration	don't try hard to read
		4	reading as comprehension	don't understand what is read
5.	goal	0	focus on mechanics	pause at periods
		1	focus on decoding	get words right
		2	speed, fluency, concentration	read fluently, concentrate
		3	use of strategy	picture the story
		4	focus on comprehension	understand what is read

6.	better reader	0	irrelevant aspects	sound out more often
		1	focus on decoding	learn more new words
		2	focus on affect	like reading better
		3	focus on practice	practise more often
		4	focus on comprehension	check and make sure comprehension
7.	age	0	irrelevant	should read like adults
		1	general, global reason	adults are smarter
		2	experiences	adults know more
		3	practice	adults read more
		4	conditional knowledge	depends on reading ability
8.	wealth	0	irrelevant	same school so same reading
		1	rich boy, general reason	John could get extra help
		2	rich boy, specific reason	John had more books to read
		3	poor boy, effort, compensation	Alan would try harder
		4	conditional knowledge	depends on interests, reading time, effort, etc.
9.	arithmetic	0	irrelevant	yes, might have more books
		1	general intelligence	yes, might be smarter
		2	specific dependence	yes, math requires reading
		3	exclusion	could be good at one not other
		4	different skills	math & reading not necessarily related
10.	good reader	0	age	older
		1	focus on decoding	know big words
		2	focus on affect	enjoy reading
		3	focus on practice	read a lot
		4	focus on comprehension	understand what is read
11.	first sentence	0	irrelevant	starts with a capital letter
		1	surface feature	begins with "once upon a time"
		2	first thing	tells what happens first
		3	general features	describes people, setting, etc.
		4	introduction, basic idea	tells what it is about

12.	last sentence	0	irrelevant	stop reading
		1	surface feature	ends with "they live happily forever"
		2	last thing	tells what happens last
		3	general features	tells how things turn out
		4	summary, conclusion	sums up, concludes the story
13.	length	0	irrelevant	Joan, story harder
		1	focus on length (general)	Joan, story longer
		2	focus on length (specific)	Joan, may have more lines
		3	focus on story type	depends on story type, level
		4	focus on reading ability	depends on better reading ability
14.	skim	0	no use of strategy	read every word, sentence
		1	easy sentences	easy ones, read faster
		2	hard sentences	hard ones, more information
		3	important sentences	ones that tell most about the story
		4	coherent strategy	skim beginning, middle, final parts
15.	difficulty	0	mechanical aspects	print too small
		1	external situation	room noisy
		2	word level	big word, long words
		3	background knowledge	unfamiliar topic
		4	reading as comprehension	story doesn't make sense
16.	word	0	lack of trying	skip it (no indication of coming back
		1	implausible attempt	look at it again
		2	sound out, syllabify	sound out
		3	consult dictionary	look up in dictionary
		4	use of context	read words around, see how it fits (include skip and come back if use of context implied)

17.	sentence	0	lack of trying	skip it
		1	implausible attempt	sound out all words
		2	rereading	read it over and over
		3	external hints	look up hard words, look at illustrations
		4	use of context	read sentence before and after, see how it fits
18.	evaluation	0	irrelevant, mechanical	don't skip words
		1	word decoding	read words properly
		2	speed, fluency	read fast, smoothly
		3	affect, concentration	get into it, want to go on
		4	comprehension	everything makes sense
19.	image	0	no use of strategy	no, don't make up pictures
		1	use strategy, no explanation	yes, just comes to me
		2	as a support strategy	yes, so not distracted
		3	for fun, more interesting	yes, makes reading fun
		4	for comprehension	yes, helps comprehension,memory
20.	rereading	0	no use of strategy	no, never
		1	word level	yes, if forget some words
		2	as a general strategy	yes, it's good practice
		3	for memory	yes, if forget information
		4	for comprehension	yes, if don't understand

Appendix E

Metacognitive Questionnaire Items

(random ordered)

1. I asked a girl named Joan to read a story that was five pages long, and a girl named Mary to read a story that was two pages long. Which girl took longer to read her story?
   a. Joan, because her story was harder.
   b. It depends on how many lines each girl had to read.
   c. It depends on who was the better reader.
   d. Joan, because her story was longer.
   e. It depends on what kind of story they were reading.

2. Do you think children your age read as well as adults?
   a. No, because adults are smarter.
   b. Yes, because we should read as well as adults.
   c. No, because adults know more than children my age.
   d. Yes, because some children my age read really well and some adults aren't good at reading.
   e. No, because adults have more practice in reading.

3. When you're reading, do you ever make up pictures in your head? Why?
   a. Yes, it makes the story easier to understand.
   b. Yes, it makes reading more interesting.
   c. Yes, it helps me not to be distracted.
   d. No, not really because I'm more interested in the words.
   e. Yes but I don't know why; it just comes to me.

4. What do you like about reading?
   a. I like reading because it can keep me away from doing other things.
   b. I don't really like reading that much.
   c. I like reading because it's fun, interesting and sometimes exciting.
   d. I like reading because I can expand my knowledge, learn more about people and the world.
   e. I like reading because it's a good way to past time.

5. The other day I talked to a boy who was really good at math. Do you think he was also a good reader? Why?
   - a. No, because he could be good at math but not good at reading.
   - b. Yes, because he might have more books at home.
   - c. No, because math and reading are different skills.
   - d. Yes, because he must be able to read for problem solving in math.
   - e. Yes, because he might be smarter than other children.

6. What does the first sentence usually do for a paragraph or story ?
   - a. It describes the people, the setting, the time, etc.
   - b. It tells what happens first.
   - c. It tells what the story is to be about.
   - d. It begins with "once upon a time" or "one day".
   - e. It starts with a capital letter.

7. Are there times when you think of yourself as a "poor" reader?
   - a. Yes, when I don't get what the book is trying to tell me.
   - b. Yes, when I'm lazy and don't try really hard to read.
   - c. No, not really because I'm always a good reader.
   - d. Yes, when there are big words that I don't know.
   - e. Yes, most of the time because I read choppy.

8. Suppose there were two boys named John and Alan who came from different homes. John's parents were rich and John had lots of toys and books. Alan's parents were poor and didn't have many books at home. Do you think one of these boys was a better reader at school?
   - a. Yes, John would be a better reader because he could get extra help.
   - b. It depends on who enjoyed reading more and who spent more time to read.
   - c. Yes, John would be a better reader because he had more books to read.
   - d. No, they would be the same if they went to the same school.
   - e. Yes, Alan would be a better reader because he would try harder to read at school.

9. When you're reading, what do you do if there's a word you don't understand?
    a. I just skip it.
    b. I look at the word again and again.
    c. I try to sound it out.
    d. I look it up in a dictionary.
    e. I read the words around it and see how it fits the sentence.

10. What would help you become a better reader?
    a If I practise reading more often.
    b. If I check and make sure I understand what I read.
    c. If I learn more new words.
    d. If I sound out loud more often.
    e. If I like reading better.

11. If I asked you to read a story really fast and you could only read some sentences, which ones would you try to read?
    a. The easy ones so I could read faster.
    b. The ones that told me most about the story.
    c. The beginning, a couple in the middle and the final sentences to get the basic idea of the story.
    d. I read every sentence from the beginning until I was asked to stop.
    e. The hard ones because they have more information.

12. What do you dislike about reading?
    a. I enjoy reading most of the time.
    b. I don't like reading stories that don't make sense to me.
    c. I don't like reading aloud.
    d. Reading is usually boring.
    e. I don't like reading stories that make me upset or scared.

13. What does the last sentence do for a story or a paragraph?
    a. I stop reading.
    b. It tells what happened at the end.
    c. It sums up what was talked earlier.
    d. It ends the story.
    e. It tells how people solved problems and how things turned out.

14 What makes something difficult to read?

a. If the story doesn't really make sense.

b. If the print is small.

c. If it is a topic that I don't know much about.

d. If the room is noisy.

e. If there are long words, hard words.

15. Are there times when you think of yourself as a "good" reader?

a. Yes, when I so get into the book that I don't know the time past.

b. Yes, when I can read most of the words.

c. Yes, when I understand what's going on in the book.

d. No, not really because I'm always a poor reader.

e. Yes, when I can read really fast and smoothly.

16. Please finish this sentence: When I read, I try to ....

a. get all the words right.

b. pause at periods.

c. concentrate on reading.

d. make sure I understand what it is about.

e. get into the book and picture what's going on in my mind.

17. Do you ever have to go back and read things over? Why?

a. Yes, if I couldn't remember what happened in the story.

b. Yes, if I read something that doesn't make sense to me.

c. No, not really unless I want to read the book again.

d. Yes, if I forgot some words.

e. Yes, because it's good practice.

18. What do you do if you don't understand a whole sentence?

a. I look up the words that I don't know in a dictionary.

b. I read it over a couple times.

c. I just skip it.

d. I try to sound out all the words in that sentence.

e. I read the sentences before and after that sentence to see what might fit in the middle.

19 What makes someone a really good reader?

a. Good readers understand what they read.
b. Good readers enjoy reading.
c. Good readers know how to pronounce big words.
d. Good readers read a lot.
e. Good readers are older in age.

20. When you read a story, how can you know you're reading it well?

a. If I can read really fast.
b. If I don't skip words.
c. If everything makes sense to me.
d. If I can read the words properly.
e. If I really get into it and want to go on and on.

Appendix F

Metacognitive Questionnaire Scoring Key

1. I asked a girl named Joan to read a story that was five pages long, and a girl named Mary to read a story that was two pages long. Which girl took longer to read her story?
   (0) a. Joan, because her story was harder.
   (2) b. It depends on how many lines each girl had to read.
   (4) c. It depends on who was the better reader.
   (1) d. Joan, because her story was longer.
   (3) e. It depends on what kind of story they were reading.

2. Do you think children your age read as well as adults?
   (1) a. No, because adults are smarter.
   (0) b. Yes, because we should read as well as adults.
   (2) c. No, because adults know more than children my age.
   (4) d. Yes, because some children my age read really well and some adults aren't good at reading.
   (3) e. No, because adults have more practice in reading.

3. When you're reading, do you ever make up pictures in your head? Why?
   (4) a. Yes, it makes the story easier to understand.
   (3) b. Yes, it makes reading more interesting.
   (2) c. Yes, it helps me not to be distracted.
   (0) d. No, not really because I'm more interested in the words.
   (1) e. Yes but I don't know why; it just comes to me.

4. What do you like about reading?
    (1) a. I like reading because it can keep me away from doing other things.
    (0) b. I don't really like reading that much.
    (3) c. I like reading because it's fun, interesting and sometimes exciting.
    (4) d. I like reading because I can expand my knowledge, learn more about people and the world.
    (2) e. I like reading because it's a good way to past time.

5. The other day I talked to a boy who was really good at math. Do you think he was also a good reader? Why?
    (3) a. No, because he could be good at math but not good at reading.
    (0) b. Yes, because he might have more books at home.
    (2) c. No, because math and reading are different skills.
    (4) d. Yes, because he must be able to read for problem solving in math.
    (1) e. Yes, because he might be smarter than other children.

6. What does the first sentence usually do for a paragraph or story ?
    (3) a. It describes the people, the setting, the time, etc.
    (2) b. It tells what happens first.
    (4) c. It tells what the story is to be about.
    (1) d. It begins with "once upon a time" or "one day".
    (0) e. It starts with a capital letter.

7. Are there times when you think of yourself as a "poor" reader?
    (4) a. Yes, when I don't get what the book is trying to tell me.
    (3) b. Yes, when I'm lazy and don't try really hard to read.
    (2) c. No, not really because I'm always a good reader.
    (1) d. Yes, when there are big words that I don't know.
    (0) e. Yes, most of the time because I read choppy.

8. Suppose there were two boys named John and Alan who came from different homes. John's parents were rich and John had lots of toys and books. Alan's parents were poor and didn't have many books at home. Do you think one of these boys was a better reader at school?
    (1) a. Yes, John would be a better reader because he could get extra help.
    (4) b. It depends on who enjoyed reading more and who spent more time to read.
    (2) c. Yes, John would be a better reader because he had more books to read.
    (0) d. No, they would be the same if they went to the same school.
    (3) e. Yes, Alan would be a better reader because he would try harder to read at school

9. When you're reading, what do you do if there's a word you don't understand?
    (0) a. I just skip it.
    (1) b. I look at the word again and again.
    (2) c. I try to sound it out.
    (3) d. I look it up in a dictionary.
    (4) e. I read the words around it and see how it fits the sentence.

10. What would help you become a better reader?
    (3) a. If I practise reading more often.
    (4) b. If I check and make sure I understand what I read.
    (1) c. If I learn more new words.
    (0) d. If I sound out loud more often.
    (2) e. If I like reading better.

11. If I asked you to read a story really fast and you could only read some sentences, which ones would you try to read?
    (1) a. The easy ones so I could read faster.
    (3) b. The ones that told me most about the story.
    (4) c. The beginning, a couple in the middle and the final sentences so I get the idea of the story.
    (0) d. I read every sentence from the beginning until I was asked to stop.
    (2) e. The hard ones because they have more information.

12. What do you dislike about reading?
    3. a. I enjoy reading most of the time.
    4. b. I don't like reading stories that don't make sense to me.
    1. c. I don't like reading aloud.
    0. d. Reading is usually boring.
    2. e. I don't like reading stories that make me upset or scared.

13. What does the last sentence usually do for a story or a paragraph?
    (0) a. I stop reading.
    (2) b. It tells what happened at the end.
    (4) c. It sums up what was talked earlier.
    (1) d. It ends the story.
    (3) e. It tells how people solved problems and how things turned out.

14 What makes something difficult to read?
    (4) a. If the story doesn't really make sense.
    (0) b. If the print is small.
    (3) c. If it is a topic that I don't know much about.
    (1) d. If the room is noisy.
    (2) e. If there are long words, hard words.

15. Are there times when you think of yourself as a "good" reader?
(0) d. No, not really because I'm always a poor reader.
(1) b. Yes, when I can read most of the words.
(2) e. Yes, when I can read really fast and smoothly.
(3) a. Yes, when I so get into the book that I don't know the time past.
(4) e. Yes, when I understand what's going on in the book.

16. Please finish this sentence: When I read, I try to ....
(0) b. pause at periods.
(1) a. get all the words right.
(2) c. concentrate on reading.
(3) e. get into the book and picture what's going on in my mind.
(4) d. make sure I understand what it is about.

17. Do you ever have to go back and read things over? Why?
(3) a. Yes, if I couldn't remember what happened in the story.
(4) b. Yes, if I read something that doesn't make sense to me.
(0) c. No, not really unless I want to read the book again.
(1) d. Yes, if I forgot some words.
(2) e. Yes, because it's good practice.

18. What do you do if you don't understand a whole sentence?
(3) a. I look up the words that I don't know in a dictionary.
(2) b. I read it over a couple times.
(0) c. I just skip it.
(1) d. I try to sound out all the words in that sentence.
(4) e. I read the sentences before and after that sentence to see what might fit in the middle.

19 What makes someone a really good reader?
(4) a. Good readers understand what they read.
(2) b. Good readers enjoy reading.
(1) c. Good readers know how to pronounce big words.
(3) d. Good readers read a lot.
(0) e. Good readers are older in age.

20. When you read a story, how can you know you're reading it well?
    - (2) a. If I can read really fast.
    - (0) b. If I don't skip words.
    - (4) c. If everything makes sense to me.
    - (1) d. If I can read the words properly.
    - (3) e. If I really get into it and want to go on and on.

Appendix G

Table G-1
ANOVA for Interview Data involving 2 (reader ability) x 2 (interview order)
(N=59)

Source	DF	MS	F	Sig. of F
A (Reader Ability)	1	6.643	61.036	.000
B (Interview Order)	1	1.497	13.759	.000
A x B	1	.085	.781	.381
Error	55	.109		

Table G-2
Means and Standard Deviations of the Interview Mean Scores for the Subjects by Reader Ability and Interview Order

Reader Ability		Interview Order	
		1	2
Skilled	M	2.98 (N=14)	3.22 (N=15)
	SD	0.32	0.26
Less Skilled	M	2.23 (N=15)	2.62 (N=15)
	SD	0.37	0.37

Appendix H

Table H-1
ANOVA for Questionnaire Data involving 2 (reader ability) x 2 (Questionnaire order)
(N=59)

Source	DF	MS	F	Sig. of F
A (Reader Ability)	1	2.799	26.628	.000
B (Questionnaire Order)	1	.002	.017	.897
A x B	1	.006	.053	.819
Error	55	.105		

Table H-2
Means and Standard Deviations of the Questionnaire Mean Scores for the Subjects by Reader Ability and Questionnaire Order

Reader Ability		Questionnaire Order	
		1	2
Skilled	M	2.97 (N=15)	2.98 (N=14)
	SD	0.23	0.32
Less Skilled	M	2.56 (N=15)	2.53 (N=15)
	SD	0.38	0.35

Appendix I

Learning Process Questionnaire (Biggs & Mulcahy, 1988)

1. I want to take only those subjects in school that would help me get a job, not those that might be more interesting.
2. I find that at times my school work can give me a good feeling inside.
3. I try to get high marks in all my subjects because I like to beat the other kids.
4. I tend to study only what the teacher says, no more.
5. While I am learning things in school, I try to think of how useful they would be in real life.
6. I have a system for keeping my books, scribblers and other class things so that I can find them easily.
7. When I do poorly on a test, I worry about how I will do on the next one.
8. Although others may know better than I do, I feel I have to say what I think is right.
9. I really want to do better than everyone else in all of my schoolwork.
10. The best way for me to learn is to memorize things by heart.
11. In reading new stuff, I am often reminded of things I already know, and see them in a different way.
12. I try to plan my work all through the school year so that I get the best grades I can.
13. The only reason I can see for working hard in school is to get a good job when I leave school.
14. I find that many subjects can become very interesting once you get into them.
15. I like the results of tests to be put up in class so that the others can see how much I beat them by.
16. I prefer subjects in which I have to learn a lot of facts to ones in which I have to do a lot of reading and understanding.
17. I like to form my own ideas on a topic before I feel good about it.
18. I try to do all of my assignments as soon as they are given to me.
19. Even when I have studied hard for a test, I worry that I may not be able to do well on it.

20. I find that learning some topics can be really exciting.
21. I would rather do well in school than be popular with my class mates.
22. In most subjects I only work hard enough to make sure I pass.
23. I try to relate what I learn in one subject to other subjects.
24. I review soon after most lessons to make sure I understand what was taught.
25. I don't think that teachers should expect us to work on things that are not part of the school curriculum.
26. I feel that I might one day be able to change things in the world that I see now to be wrong.
27. I will work for top marks whether or not I like the subject.
28. I find it better to learn just the facts and details about something rather than try to figure it out myself.
29. I find that most new things taught in school are interesting and I may even spend extra time finding out more about them.
30. When a test is returned, I correct all the errors I made and try to see why I made them.
31. I only want to stay in school long enough to get a good job.
32. I believe that school is to help me to become my own person.
33. I see doing well in school as a sort of game, and I play to win.
34. I don't spend time on learning things that I know won't be on the tests.
35. I spend a lot of my free time finding out more about interesting things that have been talked about in class.
36. I try to read all the things the teacher says we should.

Appendix J

Table J-1
Multivariate Analysis of Variance of LPQ Scale Scores by Skilled and Less Skilled Readers

Multivariate Test	F	DF	Sig. of F
Wilks Lamda	10.573	3, 55	.000
Univariate F-tests (DF=1,57)			
Scale	MS	F	Sig. of F
Surface Approach	1117.877	31.634	.000
Deep Approach	1.218	.030	.864
Achieving Approach	22.388	.547	.463

Table J-2
Multivariate Analysis of Variance of LPQ Composite Scores by Skilled and Less Skilled Readers

Multivariate Test	F	DF	Sig. of F
Wilks Lamda	13.623	3, 56	.000
Univariate F-tests (DF=1,57)			
Composite	MS	F	Sig. of F
Surface Achieving	1456.665	15.264	.000
Deep Achieving	34.048	.268	.607

Appendix K

Background Knowledge Questionnaire

How much do you know about the following topics/things?
For each question you will have 5 choices. Choose one answer for each question.

Decide, after reading each item if it is:
1. I know very very little or nothing about this.
2. I know a little bit about this.
3. I know something but not a lot about this.
4. I know quite a lot about this.
5. I know everything or almost everything about this.

How much do you know about:

a. Bananas ___

b. Polar bears ___

c. Opera singers ___

d. Rodeo clowns ___

e. Pottery ___

f. Penguins ___

Appendix L

Reading Passages for the Error Detection Task

Bananas

(grade 4 level, errors inserted)
113 words, 11 sentences, 12 units
131.97 syllables per 100 words
9. 73 sentences per 100 words
Fry readability: Grade 4

You perhaps know that bananas don't have seeds like apples.
But, did you know that bananas don't grow on trees?
In fact, the banana plant is not a tree
because it has no trunk or branches.
Bananas need a lot of sunshine and retaw to grow.
They are grown in South and Central America and in India.
The weather in these places is hot and damp.
Bananas grow from flowers on the banana tree branches.
They are picked before they get ripe.
When bananas get ripe, their color from turns yellow to green.
The banana plants die down after just one crop.
New plants are grown from the roots of the old plants.

Bananas

(grade 6 level, errors inserted)
113 words, 10 sentences, 12 units
139.64 syllables per 100 words
8.85 sentences per 100 words
Fry readability: Grade 6

You probably know that bananas don't have seeds like apples
However, were you aware that bananas don't grow on trees?
In fact, the banana plant is not a tree
because it has no trunk or branches.
Bananas require a lot of sunshine and retaw to grow.
They are grown in South and Central America and in India
where the climate is hot and humid.
Bananas grow from flowers on the banana tree branches.
They are cut down before they get ripe.
When bananas get ripe, their color from turns yellow to green.
The banana plants perish after just one harvest
and new plants are grown from the roots of the old plants.

Bananas

(Comprehension questions)

1. Bananas are grown in:
   - a. South America, Alaska, India
   - b. South America, Central America, Alaska
   - *c. South America Central America, India
   - d. Central America, Alaska, India

5. Which title best tells what this passage is about?
   - a. The Banana Farm
   - *b. How Bananas Grow
   - c. How to Pick Bananas
   - d. Bananas and Apples

3. According to the passage, which one is NOT true?
   - a. Bananas don't have seeds like apples.
   - *b. Bananas are picked when they are ripe.
   - c. New banana plants are grown from the roots of old plants.
   - d. The banana plant has no trunk.

4. After the bananas are picked, what happens to the plant?
   - a. Its grows taller.
   - b. It grows more bananas.
   - c. It is chopped down.
   - *d. It dies

5. Bananas are grown in places that are hot and:
   - *a. rainy
   - b. windy
   - c. dry
   - d. cloudy

*denotes answer key

Polar Bears

(grade 4 level, errors inserted)
119 words, 14 sentences, 14 units
135.78 syllables per 100 words
11.76 sentences per 100 words
Fry readability: Grade 4

The polar bear is the king of the frozen north.
His white fur is very similar to his surroundings.
It helps him in hunting.
The polar bear's vision is very good and a sense of sharp smell he has.
He is the best swimmer of the bear family.
Fish, seals, and sea lions are his food.
Sometimes he can't catch them because they can easily see his white fur.
In winter the mother bear buries herself in the snow.
The young cubs are born there.
The cubs are only 25 centimeters long.
They weigh about one kilogram.
When fully grown these bears weigh about 700 kilograms
They stand three terems in height.
The polar bears live about forty years.

Polar Bears

(grade 6 level, errors inserted)
128 words, 11 sentences, 14 units
136.03 syllables per 100 words
8.59 sentences per 100 words
Fry readability: Grade 6

The polar bear is the king of the frozen north.
His white fur is so similar to his surroundings
that it helps him in hunting.
His vision is excellent and a sense of sharp smell he has.
The polar bear is the superior swimmer of the bear family.
Fish, seals, and sea lions furnish most of his food.
Sometimes he can't catch them because they can easily see his white fur.
During the winter the female bear buries herself in the snow
where the young cubs are born.
The cubs are only 25 centimeters long
with a weight of not more than one kilogram
When fully grown they weigh about 700 kilograms.
They stand three terems in height.
The life span of these bears is about forty years.

Polar Bears
(Comprehension questions)

1. For food, the polar bear hunts for:
   - a. fish, seals and plants
   - b. fish, birds and seals
   - *c. seals, sea lions and fish
   - d. sea lions, birds and plants

2. The best title for this passage is:
   - a. The Food of the Polar Bear
   - *b. The Life of the Polar Bear
   - c. Where Does the Polar Bear Live?
   - d. The Bear Family

3. Which one is NOT said in the passage:
   - *a. The polar bear is the strongest of the bear family
   - b. The polar bear can see well
   - c. The polar bear lives about forty years
   - d. The polar bear lives in cold areas

4. At birth, the polar bear cubs weigh about:
   - a. 25 kilograms
   - b. 25 grams
   - *c. one kilogram
   - d. one gram

5. How are the polar bear cubs born?
   - a. The father bear buries the cubs in the snow
   - b. The father bear buries the mother bear in the snow
   - c. The mother bear buries the father bear in the snow
   - *d. The mother bear buries herself in the snow

*denotes answer key

Opera Singers

(grade 4 level, errors inserted)
134words, 15 sentences, 16 units
136.65 syllables per 100 words
11.19 sentences per 100 words
Fry readability: Grade 4

Becoming an opera singer isn't easy.
Before singers can sing in an opera, they voices must train.for their years
Operas are written in different languages.
So singers must learn to sing in foreign languages.
They must also learn to act
because opera is a kind of marad.
Opera singers must also take good care of themselves.
They can't lose weight too fast.
They can't eat too much.
They can't sing too often.
They can't sing parts that are too high or too low for them.
A cold or sore throat might make them unable to sing.
So they must always watch out for their health.
They must eat more than other people do .
Opera singers always take good care of their voices.
Some singers won't even talk on the day they are to sing.

Opera Singers

(grade 6 level, errors inserted)
138 words, 12 sentences, 16 units
138.74syllables per 100 words
8.69 sentences per 100 words
Fry readability: Grade 6

Becoming an opera singer isn't easy.
Before singers are able to sing in an opera, they voices must train.for their years
And, since operas are written in different languages,
singers must learn to sing in foreign languages.
They must also learn to act
because opera, after all, is a kind of marad.
In addition, opera singers must take good care of themselves.
They can't lose weigh too quickly.
They can't eat too much.
They can't sing too often
or sing parts that are either too high or too low for them.
Because a cold or sore throat might make them unable to sing,
they must always watch out for their health.
They must eat more than other people do .
Opera singers are very cautious about using their voices.
Some singers won't even talk on the day they are to sing.

Opera Singers
(Comprehension questions)

1. This passage was written to:
   - a. make fun of opera singers.
   - *b. explain the training of opera singers.
   - c. explain why there are no good singers today.
   - d. explain what opera is about.

2. According, an opera singer might hurt her voice by:
   - a. travelling too much.
   - b. acting too much.
   - c. not singing everyday.
   - *d. not paying attention to her health.

3. Opera singers have to study foreign languages because:
   - a. other singers often do not speak English.
   - b. it is good for the voice.
   - c. their teacher ask them to study.
   - *d. operas are written in different languages.

4. An opera singer might not talk on the day she is to sing because she would:
   - *a. want to rest her voice.
   - b. be too busy.
   - c. spend all her time dressing up herself.
   - d. be very excited.

5. According to the passage, becoming an opera singer is:
   - a. interesting.
   - *b. difficult.
   - c. boring.
   - d. silly.

*denotes answer key

Rodeo Clowns
(grade 4 level, no error inserted)
131words, 12 sentences, 15 units
128 syllables per 100 words
9.3 sentences per 100 words
Fry readability: Grade 4

Rodeo clowns make people laugh just as circus clowns do.
But their main job is to help save lives.
One big thing at a rodeo is bull riding.
When a bull throws a rider,
it often turns around and chases the rider.
The rider must escape those deadly horns.
Then it's the clown's turn to help save the rider.
They wave their arms and hats in front of the bull.
They try to show their bright and colorful clothes.
The bull then chases the clowns,
giving the rider a chance to escape.
But what about the poor clowns who are still in danger?
There is a large barrel in the center of the rodeo ring.
If a bull gets too near to a clown,
the clown dives into the barrel.

Rodeo Clowns

(grade 6 level, no error inserted)
128 words, 11 sentences, 15 units
138.28 syllables per 100 words
8.59 sentences per 100 words
Fry readability: Grade 6

Rodeo clowns entertain people just as circus clowns do.
Their essential duty, however, is to help save lives.
One important event at a rodeo is bull riding.
When a bull throws a rider,
it usually turns around and chases the rider.
The rider must escape those deadly horns.
Then it's the clown's turn to help rescue the rider.
They wave their arms and hats in front of the bull,
displaying their bright and gorgeous costumes.
The bull then chases the clowns,
providing the rider a chance to escape.
But what about the poor clowns who are still in danger?
A large barrel is kept in the center of the rodeo ring.
If a bull gets too close to a clown,
the clown makes a dive headfirst into the barrel.

Rodeo Clowns
(Comprehension questions)

1. The main job of the rodeo clown is to:
   a. ride bulls.
   b. scare bulls.
   c. trick bulls.
   *d. protect bull riders.

2. In front of the bull, the clown:
   a. tries to make it angry.
   *b. tries to get its attention.
   c. tries to stop it from running.
   d. tries to run to the exit.

3. Right after the bull throws the rider, the bull often:
   *a. chases the rider.
   b. turns to chase the clown.
   c. turns to the exit.
   d. gets away.

4. What does the rider do when the bull chases him?
   *a. It doesn't say in the passage.
   b. He dives into a barrel.
   c. He runs to the exit.
   d. He waves at the bull.

5. This passage is about:
   a. rodeos
   *b. rodeo clowns
   c. circus clowns
   d. bull riding

*denotes answer key

Pottery

(grade 4 level, no error inserted)
140 words, 14 sentences, 18 units
127.35 syllables per 100 words
10 sentences per 100 words
Fry readability: Grade 4

It is fun to watch a potter make a stoneware bowl.
First, he must have the right kind of clay.
He can mine it himself
or buy from someone who has already mined it.
Next, he chooses how to shape his bowl.
Some potters start by making rolls of clay.
They then place them on top of each other.
Other potters place the clay on a potter's wheel.
They shape the bowl as the wheel spins around
After the bowl has been shaped,
it is set aside to dry.
Then it is fired in a very hot furnace.
After the bowl has been fired once,
the potter paints a glaze on the bowl.
Then the bowl is fired again.
The glaze and the bowl harden together.
The potter now has a finished bowl,
called stoneware because of its hardness.

Pottery

(grade 6 level, no error inserted)
139 words, 10 sentences, 18 units
128.72 syllables per 100 words
7.14 sentences per 100 words
Fry readability: Grade 6

It is interesting to watch a potter make a stoneware bowl.
First, he must have the right kind of clay,
which he can either mine himself
or buy from someone who has already mined it.
Then, he must decide how to shape his bowl.
Some potters start by providing coils of clay
and placing them on top of each other.
Others place the clay on a potter's wheel,
shaping the bowl as the wheel spins around
After the bowl has been shaped,
it is set aside to dry.
Then it is placed in a very hot furnace to be fired.
After the bowl has been fired once,
a glaze is painted on the bowl
and it is fired again.
The glaze and the bowl harden together.
The potter now has a finished bowl,
called stoneware because of its hardness.

Pottery

(Comprehension questions)

1. The passage explains how to :
   - a. mine clay.
   - *b. make something.
   - c. spin a wheel.
   - d. shape a glass.

2. After a bowl has been glazed, it is:
   - *a. fired again.
   - b. set aside to dry.
   - c. set aside to harden.
   - d. finished.

3. The word "stoneware" is used to describe bowls that are:
   - a. made from stone.
   - b. very heavy.
   - *c. very hard.
   - d. unbreakable.

4. A person who doesn't have a potter's wheel makes pottery by:
   - a. waiting longer for the bowl to.harden.
   - b. buying clay from other potters.
   - c. using an extra hot furnance to fire the bowl.
   - *d. placing rolls of clay on top of each other.

5. This passage would most likely be found in a book about:
   - a. rocks.
   - b. wheels.
   - *c. art work.
   - d. mining.

*denotes answer key

Penguins

(grade 4 level, no error inserted)
121 words, 14 sentences, 16 units
135.61 syllables per 100 words
11.47 sentences per 100 words
Fry readability: Grade 4

Penguins have special nesting habits.
Each spring they return to a nesting ground.
This place has many small stones.
Here each pair of partners builds a nest of stones.
The male and female penguins take turns to collect stones.
One of them must stay to watch the nest.
Otherwise, other penguins will steal the stones.
After the nest has been built,
the mother lays the eggs.
The father sits on the eggs .
Then the mother goes to the sea to eat.
In about two weeks the mother comes back
The hungry father then goes to feed.
She sits on the eggs for two more weeks until they hatch.
The male and female penguins work together
and have their baby penguins born.

Penguins

(grade 6 level, no error inserted)
115 words, 10 sentences, 16 units
140.51 syllables per 100 words
8.69 sentences per 100 words
Fry readability: Grade 6

Penguins have special nesting habits.
Each spring they return to a nesting ground
that has many small stones.
In this place each pair of mates builds a nest of stones.
The male and female alternate collecting stones
because if the nest isn't guarded,
other penguins will steal the stones.
After the nest has been built,
the female lays the eggs.
Her mate sits on the eggs
while she goes to the sea to eat.
In about two weeks the female returns.
Then the famished male goes to feed.
The female sits on the eggs for two more weeks until they hatch.
The male and female penguins work together
and have their baby penguins born.

Penguins
(Comprehension questions)

1. About how long does it take penguin eggs to hatch?
   - a. one week.
   - b. two weeks.
   - *c. four weeks.
   - d. eight weeks.

2. After the eggs are laid, who sits on the eggs first?
   - *a. the father.
   - b. the mother.
   - c. Both the mother and father.
   - d. the eggs are left to hatch

3. This passage is mostly about:
   - a. The life of penguins
   - b. The food of penguins
   - *c. How baby penguins are born
   - d. Why penguins build nests

4. According to the passage, which one is NOT true?
   - a. The father and mother take turns to collect stones.
   - *b. The father and mother take turns to lay eggs.
   - c. The father and mother take turns to sit on the eggs.
   - d. The father and mother take turns to go to the sea.

5. When are baby penguins born?
   - *a. spring
   - b. summer
   - c. autumn
   - d. winter

*denotes answer key

Appendix M

Table M-1

Means and Standard Deviations of Error Detection Scores

(Scoring Method 2)

		Error Type					
Instruction	Group	Word		Phrase		Sentence	
General	Skilled	1.40	(1.18)	1.33	(0.90)	1.13	(0.74)
	Less Skilled	1.40	(0.83)	0.33	(0.62)	0.67	(0.82)
Specific	Skilled	2.36	(0.75)	1.36	(0.84)	1.79	(0.89)
	Less Skilled	1.33	(1.18)	0.53	(0.83)	0.93	(0.96)

Note: The maximum error detection score is 3 for each error type.
Standard deviations are in parentheses.

Table M-2

ANOVA for Error Detection Scores:

2 (Reader Group) x 2 (Instruction) x 3 (Error Type)

(Scoring Method 2)

(N=59)

Source	DF	MS	F	Sig. of F
Between				
A (Reader Group)	1	21.32	20.79	.001
B (Instruction)	1	5.08	4.95	.030
A x B	1	1.87	1.82	.183
Error	55	1.03		
Within				
C (Error Type)	2	8.24	12.03	.001
A x C	2	0.60	0.88	.417
B x C	2	0.57	0.83	.437
A x B x C	2	1.33	1.94	.149
Error	110	0.69		

Appendix N

Table N-1
Means and Standard Deviations of Error Detection Scores
(Scoring Method 3)

		Error Type					
Instruction	Group	Word		Phrase		Sentence	
General	Skilled	1.40	(1.18)	1.93	(0.70)	1.20	(0.86)
	Less Skilled	1.40	(0.83)	1.13	(0.92)	0.73	(0.88)
Specific	Skilled	2.36	(0.75)	2.07	(0.83)	1.93	(1.00)
	Less Skilled	1.33	(1.18)	1.67	(0.90)	1.07	(0.96)

Note: The maximum error detection score is 3 for each error type.
Standard deviations are in parentheses.

Table N-2
ANOVA for Error Detection Scores:
2 (Reader Group) x 2 (Instruction) x 3 (Error Type)
(Scoring Method 3)
(N=59)

Source	DF	MS	F	Sig. of F
Between				
A (Reader Group)	1	15.54	16.56	.001
B (Instruction)	1	8.46	9.01	.004
A x B	1	1.29	1.37	.247
Error	55	0.92		
Within				
C (Error Type)	2	3.72	4.53	.013
A x C	2	0.08	0.11	.900
B x C	2	0.14	0.17	.842
A x B x C	2	1.86	2.27	.108
Error	110	0.82		